

# The Effect of Supplier and Customer Industry Interrelations on Mutual Fund Investment and Performance

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## Abstract

We examine whether mutual fund managers use information on the economic linkages between an industry and its supplier and customer industries. We analyze a mutual fund's investment in its main industry--the industry where it invests the largest amount of money, and in related industries--the important supplier/customer industries of the main industry. We find that fund managers invest significantly more than the market average in both main and related industries. Investments in related industries relate positively to investments in the main industry and to the closeness of the linkages between the main and related industries. We also find that larger proportions of information-driven trades ("buys" when there is net outflow and "sells" when there is net inflow) are in main and related industry stocks. Finally, we present evidence that funds with higher main and related investments exhibit higher return-based and holding-based performance. Our findings suggest that the positive effect on abnormal fund performance is driven primarily by the level of investments in the related industries. Taken together, our findings indicate that fund managers who use information derived from product market supplier-customer interrelations have ability and/or exert effort.

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## **The Effect of Supplier and Customer Industry Interrelations on Mutual Fund Investment and Performance**

*"Once you've bought a stock, presumably you've learned something about the industry and the company's place within it, how it behaves in recessions, what factors affect the earnings, etc."*

*"... they have to explain what the company does. If they can't tell the class the service it provides or the products it makes, then they aren't allowed to buy."*

Quotes attributed to Peter Lynch, Manager for the Fidelity Magellan Mutual Fund (1977-1990)

“KNOW WHAT YOU OWN” tops the list of the eight fundamental principles of stock market investment advocated by Peter Lynch, arguably the most successful mutual fund manager in recent history. This principle and the quotes above highlight the importance that Peter Lynch placed on understanding a firm’s products, industry, and environment for the decision to invest in the firm’s stock. Research on whether fund managers follow the “know what you own” principle and make investment decisions based on product market information is scarce. In this article, we focus on one aspect of product market considerations, namely, the degree of interrelatedness between an industry and its supplier and customer industries. Specifically, we investigate the level of a fund’s investment in stocks of supplier/customer industries that are “important” to the industry in which the fund has its largest investment. We call the industry with the largest investment the fund’s “main” industry and the important supplier and customer industries of the main industry the “related” industries. By definition, every fund has to have a main industry and this main industry is linked to the “related” industries in one way or another. These links form channels for information to flow between main and related industries. A fund manager’s decision to invest in the main industry can be driven by information or can simply be risky speculation. However, if a fund has significant investment in related industries, we conjecture that it is most likely to be based on information resulting from the manager’s

information-generating activities for the main industry. We present evidence that supports the above conjectures and indicates that a fund manager can possess special abilities and/or information which results in superior performance for the fund.

A mutual fund's performance is the aggregation of the performance of all the stocks in its portfolio, particularly the stocks of firms in which the fund has significant investments. A firm's performance in the product market ultimately determines its stock performance; performance in the product market depends crucially on the terms and conditions of the firm's relations with its suppliers and customers; and the magnitude of this effect depends on the closeness of the link between the firm and its supplier/customer. Thus, a supplier whose product is a major input in the firm's production process is more closely linked to the firm than another whose product is just a minor input. The spillover of information from the main industry to its supplier/customer industries should, therefore, be greater when product market linkages between the firm and its supplier/customer industries are closer. It follows that a fund manager who selects the main industry based on skill or effort is also more likely to be in a position to take advantage of the interrelations between the main and related industries. Therefore, investments in related industries can be used to differentiate whether or not investments in the main industry are driven by information and to detect fund managers who have "superior ability" or "work hard."

Since information is costly to produce and fund managers have limited resources, it is reasonable to assume that they expend disproportionately more effort on a limited number of stocks in their portfolio; likely those stocks in which the fund has the largest investments. Therefore, we focus our investigation on a fund's main and related industries. If a fund manager's investment in the main industry is due to information, then it should be less costly for the manager to gather information about related than non-related stocks because of the economic

linkages between the main and related industries. Since a fund manager will invest in related industries only when the information is favorable, we hypothesize that the level of investment in related industries (if any) should be increasing in both the level of investment in the main industry and the closeness of its linkages with supplier/customer industries. Further, if investments in the main and related industries are driven by information, we should also find evidence of information motivation in a fund's trading of main and related industry stocks. Finally, more able and/or harder working managers should make better use of this product market information and, therefore, we hypothesize that funds with higher levels of main and related investments should demonstrate better performance.

We test the above hypotheses on the holdings and returns of a large sample of US equity mutual funds over the period 1980 – 2006. We compute a fund's "main investment" as the level of investment by the fund in its main industry. For each fund's main industry, we determine the most important supplier and customer industries using information from the *Bureau of Economic Analysis Benchmark Input-Output Make and Use (I/O)* tables, and denote the fund's investment in the stocks of these industries as "related investment." We also compute the degree of interrelatedness between an industry and its supplier and customer industries from this data source. In our sample, over half the funds concentrate more than 12.8% of their investments in the stocks of the main industry. Equally importantly, we find that half the mutual funds invest 6.5% or more in stocks of related industries and that related investments can reach as high as 63% of a fund's portfolio holdings.

After controlling for potential endogeneity in the determination of main and related investments, we find that a fund's level of investment in related industries is increasing in the level of its main investment as well as in the degree of interrelatedness between the main and

supplier/customer industries. We then investigate a fund's trades during periods of net inflows and net outflows and find evidence consistent with the hypothesis that when a fund's trades are likely to be information-motivated, the proportions of trades in stocks of the main and related industries increase. Finally, we investigate the effects of levels of main and related investments on fund performance. Using both return-based and holding-based performance measures, we find that funds with higher levels of main or related industry investments outperform funds with lower levels of these investments. Multivariate regression analysis of the relation between abnormal fund performance and main and related investments, however, reveals that higher investments in related industry stocks play more important role in driving superior performance.

The main contribution of our paper is in empirically examining whether the linkages with supplier and customer industries have an impact on fund investment and performance. There is a large body of literature that examines the effect of product-market-based economic linkages on corporate financial decisions (see Maksimovic (1995) for a survey). In particular, research has shown the importance of supplier/customer relations for corporate decisions such as capital structure, mergers and acquisitions, corporate diversification, as well as for predictability of stock returns.<sup>1</sup> If supplier-customer relations have a large impact on corporate decisions, a skilled/hard-working fund manager should pay attention to them. To the best of our knowledge, ours is the first study that investigates the relevance of these product market linkages in determining mutual fund investments and performance; and our findings suggest that this relevance is strong.

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<sup>1</sup> For evidence on the relevance of supplier/customer relations to corporate diversification, see Fan and Lang (2000), to wealth effects of horizontal mergers, see Shahrur (2005), and to corporate debt levels, see Kale and Shahrur (2007). Cohen and Frazzini (2008) show that stock prices do not reflect the economic linkages between a firm and its corporate customers in a timely manner. As a result, the stock prices of "economically linked" firms are predictable.

In the mutual fund literature, the paper that most closely relates to ours is Kacperczyk, Sialm, and Zheng (2005). These authors study the impact of industry concentration on fund performance by constructing a Herfindahl Concentration Index computed from a fund's holdings in each of the ten industry classifications and find that both return-based and holding-based fund performance measures are increasing in this Index. Since a higher value of the industry concentration index reflects a greater deviation from a well-diversified portfolio, the authors suggest that the positive relation between the index and fund performance indicates that managers possess superior information. Our paper builds on the insights provided in Kacperczyk, Sialm, and Zheng (2005) but differs in some important ways. First, we assign a fund's stock holdings to a finer partition of about 300 industry classifications. Second, we focus on a subset of the fund's portfolio that consists of stocks in the main industry and related industries. The rationale is that fund managers only have limited resources and will expend more effort on some stocks than other stocks, and the stocks on which they focus should be those with heavier weights in the fund portfolio. Finally, by investigating investments in related industries, we are able to determine whether fund managers use product market information to manage their investments.

Another paper we draw from is Alexander, Cici, and Gibson (2007), which proposes that "sell" trades are motivated by liquidity and "buys" by information when a fund experiences a net outflow, and shows that the performance of information-motivated buys significantly beats the market. These findings indicate that managers have access to private information and generate superior returns by its use. Consistent with the findings in Alexander, Cici, and Gibson (2007), we find that when funds make information-induced trades, the proportion of trades in the main

and related industry stocks is higher, suggesting that investments in the main and related industries are indeed likely to be information motivated.

At a general level, our paper belongs to the set of papers that followed in the wake of the seminal finding in Jensen (1968) that the abnormal returns of mutual funds are more often negative than positive (see also Elton *et al* (1992)). Later papers (e.g., Ippolito (1989), Brown and Goetzmann (1995), Gruber (1996), Malkiel (1995), and Carhart (1997)) provide further evidence that the risk-adjusted net-of-expenses returns to funds are either zero or negative. The consensus in this strand of literature is that fund managers do not exhibit superior ability or possess information. However, other researchers argue that lack of superior performance is not necessarily equivalent to lack of superior information. Berk and Green (2004) show that mutual funds may not exhibit superior return performance even if fund managers possess superior ability because competition for the limited supply of skill may drive the abnormal return to zero.<sup>2</sup>

The results in our paper supplement the findings in the literature that provides evidence on mutual fund managers' stock picking ability by analyzing fund stock holdings. These papers include Grinblatt and Titman (1989, 1993), Daniel, Grinblatt, Titman, and Wermers (1997), Wermers (1999, 2000), and Chen, Jegadeesh, and Wermers (2000). Daniel *et al* (1997) provide the measures for a fund manager's stock selection and timing ability based on the fund's portfolio holdings. Chen, Jegadeesh, and Wermers (2000) analyze the performance of stocks traded by mutual funds and find that the stocks they purchase outperform the stocks they sell. Other papers (Gompers and Metrick (2001), Sias, Starks, and Titman (2006), and Schultz

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<sup>2</sup> Edelen (1999) provides evidence that the negative impact of the liquidity-induced trades offsets the positive effect of information-induced trades resulting in an abnormal performance that is essentially zero. Chen, Hong, Huang, and Kubik (2004) show that fund returns decline in lagged fund size (see also Grinblatt and Titman (1989) for some weak evidence) and ascribe this negative relation to liquidity costs, showing that the negative relation is strongest for funds that invest in larger numbers of small stocks.

(2007)) also provide evidence that institutional trades have a positive correlation with future stock returns, suggesting that mutual funds have the ability to pick stocks. Additional empirical measures of fund managers' superior skills/information include investment consistency with star managers proposed by Cohen, Coval, and Pastor (2005), reliance on private information analyzed by Kacperczyk and Seru (2007), unobserved activeness suggested by Kacperczyk, Sialm, and Zheng (2008), investment in stocks with higher probability of informed trading studied by Da, Gao, and Jagannathan (2007), and intra-quarter round-trip trades investigated by Puckett and Yan (2008). Baker, Litov, Wachter, and Wurgler (2007) present evidence of superior (inferior) returns around subsequent earnings announcements of purchased (sold) stocks and interpret these findings as indicating a superior ability to "forecast economic fundamentals." We take a different approach by resorting to the product market, which determines the fundamentals of the stock returns. Our contribution to this strand of literature is identifying a specific category of information, that pertaining to the economic linkages between the main and supplier/customer industries, and providing evidence that fund managers obtain and use this information to make investment decisions. While our findings are consistent with the theme that mutual fund managers do have skills/information, we extend the literature by identifying a specific type of information they have and confirming that they do make use of the information to generate superior performance.

The rest of the paper is organized as follows. The next section describes the data and variable construction, and analyzes several sample characteristics. In Section 2, we present our results on the determinants of investments in related industries. Section 3 presents the findings from our analysis of informed trading in main and related industry stocks. The results from the

analyses relating main and related investments to fund performance are in Section 4. We provide robustness check results in Section 5 and Section 6 offers concluding remarks.

## **1. Data, Variable Descriptions, and Sample Characteristics**

### **1.1 Data**

We construct our sample by merging the *Thomson Financial CDA Spectrum Institutional Holdings* database, which provides common stock holdings of institutional money managers who file 13f reports with the SEC, and the *Center for Research in Security Prices (CRSP) Survivorship Bias Free Mutual Fund Database*. We obtain information on fund objectives and stock holdings in each quarter from the CDA holdings database, and information on fund age, total net assets, expense ratio, and turnover ratio from the CRSP mutual fund database. The stock return data used in our analysis are from the CRSP stock database.

We obtain data on industry classifications and interrelations between supplier and customer industries from the *Bureau of Economic Analysis Benchmark Input-Output Make and Use (I/O)* tables. We use *Compustat* historical SIC codes and *North American Industry Classification System (NAICS)* codes to assign firms into I/O industries. Our final sample spans the period from the first quarter in 1980 to the fourth quarter in 2006. We use the 1982, 1987, and 1992 *Use* tables and historical SIC codes to sort stocks into industries for the periods 1980-1984, 1985-1989, and 1990-1994 respectively; and the 1997 and 2002 *Use* tables and NAICS codes to sort stocks into industries for the periods 1995-1999 and 2000-2006, respectively.<sup>3</sup> Mutual funds invest in about 200 industries (ranging from 196 to 232) over the sample period 1980-1994, and, because NAICS codes provide finer industry classifications, in about 350

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<sup>3</sup> We obtain the SIC-IO conversion table from Joseph P.H. Fan's website at Chinese University of Hong Kong <http://ihome.cuhk.edu.hk/~b109671/index.html>.

industries (ranging from 326 to 399) over the sample period 1995-2006. The variations in the number of industries are also due to the fact that the *Use* tables are updated every five years to better capture the changes in product markets and the overall economic environment.

We only include funds in investment objective categories Aggressive Growth, Growth, and Income in our sample and exclude bond, index, and international funds. Since a fund's portfolio weights must sum to 100%, if a fund invests a significant proportion in one industry, it *must* invest a relatively lower proportion in other industries. This negative relation becomes particularly acute for higher levels of investment concentration in one industry. To prevent this bias caused by overly concentrated investment in a single industry, we exclude funds that invest more than 50% in any one industry.<sup>4</sup> We also exclude funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. Our final sample of quarterly fund holdings and trades consists of 1,951 equity funds and 54,862 fund-quarter observations. Table 1 provides details about the funds in our sample. The size and age of the median fund in our sample are \$227 million and 11.41 years, respectively. The median fund invests in 63 stocks spread over 35 industries. The average expense ratio is 1.278% and the average turnover is 86.022%. The variable *Inflow* measures the ratio of a fund's net fund flow to its total net assets and we compute it as:

$$Inflow_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1} \times (1 + RET_{i,t})}{TNA_{i,t-1}},$$

where  $TNA_{i,t}$  and  $RET_{i,t}$  are both derived from the CRSP mutual fund return data, and denote fund  $i$ 's total net assets at the end of month  $t$  and its return during month  $t$ , respectively. The quarterly

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<sup>4</sup> We exclude 2595 observations (about 4.7% of the total 54,862 observations included in the sample) that invest 50% or more in a single industry; about 87% of these observations are for sector funds.

fund flow is the sum of monthly flows in the quarter. The average value of *Inflow*, winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentiles, is about 2.02%.

## 1.2 Measures of Holdings in Main and Related Industries and Industry Relatedness

The focus of our empirical analysis is on a fund's investments in "main" and "related" industries. We denote a fund's investment in its main industry with the variable *Main\_Inv*, which is the ratio of the fund's dollar amount invested in its main industry to its total equity investment. Formally,

$$Main\_Inv_{i,t} = \max_j \{Inv_{i,t,j}\} / \sum_j Inv_{i,t,j},$$

where  $j = 1, 2, \dots, N$  denotes all the industries that fund  $i$  invests in quarter  $t$ ,  $Inv_{i,t,j}$  is the dollar amount of the fund's investment in industry  $j$  and  $\max_j \{Inv_{i,t,j}\}$  is the industry with the fund's largest dollar investment.

A fund's investment in industries related to its main industry, *Rel\_Inv*, is the ratio of the fund's investment in the five most related supplier and five most related customer industries to the fund's total equity investment. Formally,

$$Rel\_Inv_{i,t} = \sum_{j \in \{S1-S5, C1-C5\}} Inv_{i,t,j} / \sum_j Inv_{i,t,j}.$$

We use information from the I/O table to construct *Rel\_Inv*. From the I/O table we obtain (i) the dollar amount needed as input from each of the main industry's supplier industries to produce one dollar of the main industry's output, and (ii) the dollar amount needed from the main industry as input to produce one dollar of output in each of the main industry's customer industries. We sort the supplier industries of the fund's main industry, from the largest to the smallest, by the dollar amount needed as input for every one dollar of the output in the main industry and identify the five most related supplier industries. We use a similar procedure to

identify the five most related customer industries. We then sum the fund's investments in stocks belonging to these ten supplier/customer industries. The ratio of this sum to the fund's total equity investment is the variable  $Rel\_Inv$ . Note that ten is the maximum possible number of industries that we use to compute  $Rel\_Inv$ ; a fund rarely invests in all the top ten supplier/customer industries.

We measure the degree of industry interrelatedness between a fund's main and related industries by the variable  $INDREL$ . Formally,

$$INDREL_{i,t} = \sum_{j \in \{s1-s5, c1-c5\}} w_{i,t,j} * Rel_{i,t,j},$$

where the industry weight  $w_{i,t,j}$  is the market capitalization of related industry  $j$  divided by the sum of the market capitalizations of the five most related supplier industries and the five most related customer industries, and  $Rel_{i,t,j}$  is the dollar amount of supplier industry  $j$ 's input needed for every one dollar of the output in main industry  $i$  or the dollar amount of main industry  $i$ 's input needed for every one dollar of the output in customer industry  $j$  in quarter  $t$ . It is important to note that the variable  $INDREL$  depends only on product market relations and not on any of the fund's investment decisions. We also construct an alternate version of  $INDREL$  that is not weighted by the industry capitalization. We show that our findings are robust to this alternate  $INDREL$  measure. In addition, we construct related measures for supplier and customer industries separately and investigate the impact of each on fund investment and performance.

### **1.3 Summary Statistics of Fund Investment in Main and Related Industries**

In Panel A of Table 2, we present the summary statistics for the main and related industry holdings for the sample of all funds. We then sort funds by their investment objectives (Aggressive Growth, Growth, and Income) and report the average holdings for funds in each

investment objective in Panel B. The median values of the variables in the table are reasonably close to the averages. The average value of *Main\_Inv* implies that on average funds invest almost 15% of their equity in the main industry, and the median value indicates that half the funds concentrate over 12.839% of their equity in the main industry. The average and median values of *Rel\_Inv* indicate that funds also make sizeable investments in related industries. The funds in our sample hold an average 7.980% of their investments in stocks of related industries and half the funds invest more than 6.453% in related industries. In results not reported in the table, we find that the correlation between *Main\_Inv* and *Rel\_Inv* is 0.25, which indicates that the greater the investment in the main industry, the greater will be the investment in related industries, and is consistent with the idea that fund investments reflect industry interrelatedness.

We next examine how fund investments in related industries differ from those in non-related industries and present the findings in the next five rows of Panel A of Table 2. First we compare the average portfolio weight of related industries with that of non-related industries, which are industries other than the main and related industries in which a fund invests. The values for *Ave\_Rel\_Inv* and *Ave\_NonRel\_Inv* indicate that the average (median) portfolio weight of investments in each related industry, 3.491% (2.858%), is greater than the average (median) portfolio weight of 2.680% (2.407%) for investments in each non-related industry. In the next row of the panel, we see that the level of fund investment in an industry when it is the main industry is 10.143% more than when it is not the main industry. Similar analysis shows that on average funds invest 1.571% more in an industry when it is a related industry than when it is not.<sup>5</sup> Finally, we sort each fund's investments in different industries from highest to lowest in each quarter and compute *%Top\_Rel\_Ind*, which is the percentage of related industries among

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<sup>5</sup> In this computation, we exclude main industries from non-related industries.

industries with portfolio weights greater than the median portfolio weight. The average (median) values indicate that 64.303% (66.667%) of the related industries are ranked among the top half based on investment weight. The average value of the interrelatedness between the main and related industries (*INDREL*) for all funds is 0.087, and the range is from 0.007 to 0.594.

The values in Panel B of the table indicate that Aggressive Growth funds have the highest levels of both *Main\_Inv* and *Rel\_Inv* followed by Growth and then Income funds. This pattern is consistent with the idea that Aggressive Growth funds are more likely to base their investments on information and thus direct larger proportions of investments into fewer industries. Although Aggressive Growth funds invest more than others in the main and related industries, the average values for *INDREL* is the lowest for these funds and the highest for Income funds, which indicates that Aggressive Growth funds exploit the product market information more aggressively and more effectively.

We next investigate the stability of a fund's main investment over time. Figure 1 shows the percentage of funds for which the main industry remains unchanged from quarter  $t$  to quarter  $t+q$ , with  $q$  equal to 1, 2, 4 (one year), 8 (two years), and 20 quarters (five years). The figure shows plots of these percentages for all the funds, funds with at least 10% investments in the main industry at the end of quarter  $t$ , and funds with more than 15% investments in the main industry at the end of quarter  $t$ , respectively. The figure shows that mutual funds have fairly stable main industries; for example, 70% of all funds in the sample have the same main industry in two consecutive quarters, and the percentage goes up to 85% for funds with at least 15% in the main industry. After one year, 50% of all the funds and 60% of those with more than 15% main investments still have the same main industry. Even after five years, 30% of all the funds and 40% of those with more than 15% investment in the main industry have the same main industry.

A fund's commitment to investments in the main industry may reflect the manager's expertise in that industry and/or the difficulty to reduce main investments due to liquidity/price pressure considerations.

## **2. Determinants of the Level of Fund Investment in Related Industries**

Our findings thus far suggest that mutual funds make significant investments in industries that are upstream and downstream to their main industry. In this section, we analyze the determinants of a fund's investment in these related industries. We show that a fund's investment in related industries is related to two variables that reflect product market linkages, namely, the level of investment in the main industry and the degree of interrelatedness between the main and related industries.

### **2.1 Product Market Linkages and Investment in Related Industries: The Hypotheses**

If the investments in the main industry are based on information, then the information that managers obtain about the main industry should be increasing in the level of investment in the main industry. Further, with more information about the main industry, product market interrelation makes it less costly to obtain information about the related supplier and customer industries than about the non-related industries. Since a fund manager will invest in related industries only when the information is favorable, this information advantage is likely to result in more investment in related industries.<sup>6</sup> Therefore, we hypothesize that *Rel\_Inv* should relate positively to *Main\_Inv*. We also hypothesize that the relevance of the main industry information to related industry investments should be increasing in the degree of interrelatedness between the

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<sup>6</sup> In a perfect world, mutual fund managers will trade on both favorable and unfavorable information. Our data source provides only the positive investments by funds and mutual funds are restricted in their ability to short sell stocks. Therefore, we consider the fund managers' reaction only to favorable information. However, our analysis of trading in main and related industry stocks suggests that managers also sell shares in reaction to unfavorable information.

main and supplier/customer industries and, therefore, we also expect that the hypothesized positive relation between *Main\_Inv* and *Rel\_Inv* will be stronger (more positive) as *INDREL* increases.

The variable of interest in the analysis, *Rel\_Inv*, and the two hypotheses regarding its determinants may be summarized as follows: (i) *Rel\_Inv* should relate positively to *Main\_Inv*, and (ii) this positive relation is strengthened by the product market linkage, i.e., the coefficient on the interaction variable *INDREL\*Main\_Inv* should be positive.

## **2.2 Addressing Endogeneity**

Since classification of an industry as related is determined by which industry is identified as the main industry, we must consider possible endogeneity between *Rel\_Inv* and *Main\_Inv* and, by extension, endogeneity between *Rel\_Inv* and *INDREL\*Main\_Inv* in designing our tests. Endogeneity concerns also arise because both *Main\_Inv* and *Rel\_Inv* are driven by the information acquisition efforts of fund managers. Our statistical tests confirm the presence of endogeneity and we address endogeneity by using the instrumental variable generalized method of moments (GMM) estimation procedure. We estimate two specifications of the GMM model. In the first specification, we include only *Main\_Inv* in addition to other control variables. For the second specification, we assume that the effect of *Main\_Inv* on *Rel\_Inv* depends on the level of product market interrelation and include both *Main\_Inv* and *INDREL\*Main\_Inv* as determinants of *Rel\_Inv*. Both specifications include year fixed effects and control for clustering and heteroskedasticity.

We identify four instrumental variables (IVs) for the GMM estimation. The first IV is *Lagged Main\_Inv*, which is the lagged investment in the main industry. The second IV is *Main\_ih*, which is the average institutional holding of stocks in the main industry. The third and

fourth IVs are the products of the first two IVs with *INDREL* (see Wooldridge (2002)). We also report the first stage results (for *Main\_Inv* and *INDREL\*Main\_Inv*) for the second specification. The “First Stage” results in the two columns of Table 3 show that coefficients of the first and the fourth IV are significant in the first-stage *Main\_Inv* regression and all four IVs are significant in the first-stage regression for *INDREL\*Main\_Inv*. The bottom panel of Table 3 presents statistics related to the presence of endogeneity and the relevance of the IVs. The statistics suggest the presence of endogeneity and also indicate that the IVs are relevant. Since we have an overidentified system with four IVs, we are also able to determine the validity of the instruments using Hansen J-Statistics. These statistics are not significant, indicating that our instruments are valid.

### **2.3 GMM Results on the Determinants of Holdings in Related Industries**

We report the GMM estimation results for the determinants of *Rel\_Inv* corresponding to the two specifications in the last two columns of Table 3. The coefficients on *Main\_Inv* are positive (0.073 and 0.057, respectively) and statistically significant in both the specifications. The positive relation between *Main\_Inv* and *Rel\_Inv* supports our hypothesis that the information on main industry is relevant to related industries and suggest that higher levels of *Main\_Inv* provide more spillover information about related industries and make it more cost-efficient to invest in the related industries. The last column presents coefficient estimates from the specification that includes the interaction between *Main\_Inv* and *INDREL*. In this specification, the coefficients on both *Main\_Inv* and the interaction term are significantly positive. The significantly positive interaction term (0.163) supports our second hypothesis that the closeness of product market interrelation determines how much information spills over from the main

industry to the related industry and has an impact on the sensitivity of related investments to the main investment.

The coefficients on the control variables are by and large consistent with expectations. The coefficient on the lagged value for *Rel\_Inv* is significantly positive, showing that some of the investments in the related industries are inherited from the past. Earlier research (e.g., Badrinath, Gay, and Kale (1989) and Badrinath, Kale, and Noe (1995)) shows that a number of firm and industry characteristics are important determinants of the level of institutional interest in a firm. The variables in our analysis, *Main\_Inv* and *Rel\_Inv*, are at the industry level and *Rel\_Inv* spans as many as ten industries. Therefore, it is not possible for us to include as controls variables that directly reflect firm and industry characteristics. Instead, we include the variable *Rel\_ih*, which is the average institutional ownership in related industries and reflects the aggregated firm and industry characteristics that determine the level of institutional interest in a firm's stock. The coefficient on *Rel\_ih* is significantly negative, which suggests that when institutional interest in a fund's related industries is high, the benefit of spillover information from the main industry is lower and, hence, the fund manager's investment in his/her fund's related industries is lower. This is consistent with Kacperczyk and Seru (2007), who find that skilled managers try to avoid firms with more transparent public information, and also shows that funds have a preference for neglected firms (see Arbel, Carvell, and Strebel (1983)). Our findings suggest that older funds make lower investments in related industries and that the effect of fund inflow on related investment is insignificant, suggesting that related investment does not result from liquidity. Finally, the dummy variable for Aggressive Growth funds is significantly positive but the coefficient for Growth funds is not significantly different from zero.

In summary, the findings reported in this section highlight that fund managers appear to take into account industry interrelations based on product market considerations when they make their investment decisions. Further, the importance of these product market considerations increases as the degree of interrelatedness between the main industry and its upstream and downstream industries increases. We also show that managers will invest more in related industries when they invest more in the main industry. The positive relation between investments in the main and related industries and its dependence on *INDREL* together indicate that investments in related industries are consistent with the hypothesis of information-motivated investments by fund managers.

### **3. Evidence on Information-Motivated Trading in Stocks of Main and Related Industries**

We hypothesize that in generating information about its main industry, a fund manager also obtains information about industries that are related to the main industry in the product market and uses this information while trading in the stocks of related industries. We first present summary statistics of trading by fund managers to show that a significant portion of the fund's trading activity occurs in main and related industry stocks, and then examine whether trades in related industries are informed trades. In the spirit of Alexander, Cici, and Gibson (2007), we investigate the level of trading activity in the main and related industry stocks when funds have net inflows and outflows. If our hypothesis that trades in the main and related industry stocks are more likely to be informed trades is valid, we should see significantly more selling (buying) of the main and related industry stocks in periods of net inflows (outflows).

#### **3.1 Trading Variables and Summary Statistics**

For each fund in the sample, we define the variable *Main\_Buy* as the dollar amount used to purchase stocks in the main industry, and *Main\_Sell* as the dollar amount received from

selling stocks in the main industry. The variables *Rel\_Buy* and *Rel\_Sell* have similar meanings in the context of stocks in the fund's related industries. The variables *Total\_Buy* and *Total\_Sell* represent the dollar amount used for all stock purchases, and received from all stock sales, respectively. We then define *%Main\_Buy* as the ratio of *Main\_Buy* to *Total\_Buy* and *%Rel\_Buy* as the ratio of *Rel\_Buy* to *Total\_Buy*. Similarly, we define *%Main\_Sell* as the ratio of *Main\_Sell* to *Total\_Sell*, and *%Rel\_Sell* as the ratio of *Rel\_Sell* to *Total\_Sell*.

The summary statistics of the trade variables in Panel A of Table 4 indicate that, on average, funds purchase \$146 million and sell \$77 million worth of stocks every quarter. Their trades in the main industry stocks average \$17.125 million in buys and \$9.717 million in sells, and buying and selling in main industry stocks on average constitute 12.297% and 13.685% of the fund's total buy and sell trades, respectively. With respect to trades in related industries, on average, funds buy \$12.660 million and sell \$5.941 million worth of stocks in related industries every quarter, which represent 8.122% and 7.901% of the total buy and sell trades in a quarter.

Table 4 also reports that for Aggressive Growth funds, the buy (sell) trades in main industry stocks on average constitute 14.810% (16.047%) of the dollar volume of total buys (sells) in a quarter. The averages for Growth funds are lower and those for Income funds are the lowest at 11.310% for *%Main\_Buy* and 12.436% for *%Main\_Sell*. The average values for *%Rel\_Buy* and *%Rel\_Sell* are also the highest for Aggressive Growth funds (10.017% and 9.564%, respectively) and lowest for Income funds (7.241% and 7.117%, respectively).

### **3.2 Are Trades in Main and Related Industry Stocks Information-Driven?**

As in Alexander, Cici, and Gibson (2007), we investigate whether trades in related industries are information-driven by examining trades during periods of net inflows and net outflows. We classify funds into two groups, those with net inflows and those with net outflows.

We report the correlations among fund flows, total trades, and trades in the main and related industries in each of these two groups in Table 5. Panel A presents correlations for funds that have net inflows. Fund inflow is positively correlated with *%Total\_Buy* (0.476), *%Main\_Buy* (0.050), and *%Rel\_Buy* (0.034). The positive correlations can result from either information or liquidity, or both. However, although fund inflow is negatively correlated with *%Total\_sell* (-0.043), it is significantly positively correlated with *%Main\_sell* (0.023) and *%Rel\_sell* (0.019). Since stock sells in periods of fund inflow are more likely driven by information, the positive correlation between fund inflow and *%Main\_sell* as well as *%Rel\_sell* implies that fund managers trade main and related industry stocks based on information. Panel B presents results for all funds that have net outflows. Fund outflow correlates positively with *%Total\_Sell* (0.269) and negatively with *%Total\_Buy* (-0.070). Although the positive correlation with *%Main\_Sell* (0.018) is significant at 1% level, its correlation with *%Rel\_Sell* (0.018) is statistically insignificant. Fund outflow is negatively correlated with *%Main\_Buy* (-0.011) at 10% level, demonstrating a weak liquidity effect. However, its correlation with *%Rel\_Buy* (0.027) is positive and statistically significant, suggesting that trades in related industries are driven by information.

Next, each quarter, we sort funds in the net inflow and net outflow groups into quintiles on net inflows and net outflows and compute time series averages of equally-weighted trading variables and report the results in Table 6. Panel A of the table presents our findings for funds that have net inflows in a quarter. In this panel, inflows increase from Quintile 1 to Quintile 5 and we present measures of trading activities for each quintile in the first five rows of the panel. The last row of the panel presents the difference in averages between the fifth and the first quintile with standard errors in parentheses. The bottom entry in each cell of the last row is the

relative percentage increase in the variable from the first to the fifth quintile. We compute the ratios of total buys to total assets for funds in each quintile and report the results in column three of Panel A. As inflows increase from the first quintile to the fifth quintile, the proportion of total buys to total assets increases from 11.779% to 30.631%, a relative increase of over 160%. We then compute ratios of the dollar buys in the main and related industries to total dollar buys and report the averages for each quintile in the next two columns. The ratios of buys in the main and related industries increase by 1.909% (relatively 15.75%) and 0.559% (relatively 7.07%), respectively, from the first to the fifth quintile.<sup>7</sup>

We then compute similar ratios for total sells as well as for sells in stocks of the main and related industries and report the results in the last three columns. The total sells ratio decreases by 1.294% (relatively 19.28%) from the first to the fifth quintile, which is as is to be expected in quarters with net inflows. However, the average ratio of sells of main industry stocks increases from 13.392% in Quintile 1 to 14.372% for Quintile 5, an increase of 0.980% (or relatively 7%) but insignificant. The average ratio of sells of related industry stocks also increases from 7.627% to 8.662%, which is an increase of 0.996% (or relatively 13.06%) and significant at 5% level. The findings that the proportions of sells in the main and related industries increase with net inflows support the hypothesis that trades in main and related industries are more likely to be informed trades.

We conduct a similar analysis of trading activities in main and related industry stocks when funds have net outflows and present the results in Panel B of Table 6. The averages for the ratio of *Total\_Sell* to *Total Assets* (column six of Panel B) show an increase of 5.390% (relatively 75.45%), which is consistent with the increased selling as net outflows increase. The

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<sup>7</sup> The magnitudes of the increase percentages in main and related industry buys are not comparable to the 160% increase in total buys because the denominators in computing the ratios are different.

proportion of main industry sells increases from 13.408% to 15.884%, which is an increase of 2.436% (relatively 18.17%) and statistically significant. However, the ratio of related industry sells increases from 7.294% to 8.164%, which is a statistically insignificant increase of 0.870% (relatively 11.93%). Thus, it appears that the liquidity needs of the fund do not apply as much to stocks in the related industries as to stocks in the main industry.

The findings of the buying behavior during fund outflows are in columns three, four, and five. In times of net outflows, total buys decrease by 1.971% as outflows decrease from the first to the fifth quintile. The proportion of buys in main industry stocks, however, increases by 1.186% (from 11.579% to 12.766%), which is insignificant. The proportion of buys in related industry stocks increases from 7.439% in the first quintile to 8.179% in the fifth, an increase of 0.741% (relatively 9.96%) significant at 10% level. When there are net outflows from the fund, selling of stocks is more likely to be liquidity driven and purchases of stocks more likely to be information driven. The findings when there are net outflows, therefore, provide evidence to support the hypothesis that trades in main and related industry stocks are driven by information. Further, the findings show that trades in related industry stocks may be more likely to be information based.

#### **4. Evidence on the Relation between Related Investment and Fund Performance**

Making investment and trading decisions based on information is an important measure of the skill a fund manager possesses and the effort he/she puts into his/her job. The evidence presented thus far suggests a link between investing in related industries and the using of information by fund managers. Since every fund has a main industry by definition, we hypothesize that the level of investment in related industries is a measure that detects whether investment in the main industry results from the effort expended by a fund manager. If our

hypothesis is true then we should observe a positive relation between the level of related investment and a fund's performance.

We employ two sets of measures of fund performance; the first is based on fund returns and the second on fund holdings. In the set of fund return based measures, we include the unconditional abnormal returns from the four-factor model of Carhart (1997) and the conditional abnormal return using the Ferson and Schadt (1996) model. The Carhart four-factor model is:

$$R_{i,t} - r_{f,t} = \alpha_i + \beta_{MKT}(R_{M,t} - r_{f,t}) + \beta_{SMB}SMB_t + \beta_{HML}HML_t + \beta_{UMD}UMD_t + e_{i,t}$$

where  $R_{i,t}$  is the monthly value weighted return on the decile portfolio sorted by *Main\_Inv* or *Rel\_Inv*,  $R_{MKT,t}$  is the monthly value-weighted market return,  $r_{f,t}$  is the monthly riskfree rate, and  $SMB_t$ ,  $HML_t$ , and  $UMD_t$  are the monthly size factor, book-to-market factor and momentum factor downloaded from Kenneth French's website. Following Wermers (2003) and Kacperczyk, Sialm, and Zheng (2005), we estimate the Ferson-Schadt conditional abnormal return by adding the interactions of the excess market return and the lagged macro-economic variables into the Carhart four-factor model. The specification of the model is:

$$R_{i,t} - r_{f,t} = \alpha_i + \beta_{MKT}(R_{M,t} - r_{f,t}) + \beta_{SMB}SMB_t + \beta_{HML}HML_t + \beta_{UMD}UMD_t + \sum_{j=1}^4 \beta_{MKT,j} z_{j,t-1} (R_{M,t} - r_{f,t}) + e_{i,t}$$

where  $z_{j,t-1}$  are the demeaned economic variables, including one-month treasury bill yield, the dividend yield of the S&P 500 Index, the Treasury yield spread between the long-term and short-term bonds, and the quality spread in the corporate bond market.

In the set of holding-based measures, we include the stock selection (*CS*) and timing (*CT*)

measures using the Daniel, Grinblatt, Titman, and Wermers (1997) methodology.<sup>8</sup> A mutual fund's *CS* measure in quarter  $t$  is calculated as:

$$CS_t = \sum_{j=1}^N w_{j,t-1} (R_{j,t} - BR_{j,t-1})$$

where  $w_{j,t-1}$  is stock  $j$ 's portfolio weight at the end of quarter  $t-1$ ,  $R_{j,t}$  is stock  $j$ 's return in quarter  $t$ , and  $BR_{j,t-1}$  is the quarter  $t$  return of the benchmark portfolio that is matched to stock  $j$  based on size, book-to-market ratio, and momentum at the end of quarter  $t-1$ . The variable *CT* captures the market timing ability and is measured by examining the time-varying expected returns of portfolios sorted on the size, book-to-market, or momentum benchmark:

$$CT_t = \sum_{j=1}^N w_{j,t-1} BR_{j,t-1} - w_{j,t-5} BR_{j,t-5}$$

where  $w_{j,t-1}$  is stock  $j$ 's portfolio weight at the end of quarter  $t-5$ , and  $BR_{j,t-5}$  is the quarter  $t$  return of the benchmark portfolio that is matched to stock  $j$  based on size, book-to-market ratio, and momentum at the end of quarter  $t-5$ .

#### 4.1 Return-Based Performance Measures

For every quarter during the period 1980 – 2006, we sort mutual funds into decile portfolios according to their *Main\_Inv* and *Rel\_Inv*, and compute the unconditional (Carhart (1997)) and conditional (Ferson and Schadt (1996)) abnormal returns (alphas) on both after- and before-expenses bases. We report the various alphas for each *Main\_Inv* and each *Rel\_Inv* decile in Table 7. The last two rows of the table report the differences between the alphas of the 10<sup>th</sup> and the 1<sup>st</sup> decile and the 10<sup>th</sup> and the 5<sup>th</sup> decile, respectively. Because the sum of investments in the main industry and the related industries is capped at 100%, an increase in the portfolio weight for the main industry automatically leads to a decrease in the weights of other

<sup>8</sup> The DGTW benchmarks are available at <http://www.smith.umd.edu/faculty/rwermers/fpsite/Dgtw/coverpage.htm>.

investments, including the investments in related industries. When the proportion of main investment is very high, the proportion of related investment is likely to be lower. As a result, in deciles with very low levels of related investment, we find high levels of main investment. For this reason, the difference between the 10<sup>th</sup> decile and the 5<sup>th</sup> decile is likely to highlight the relation between levels of *Rel\_Inv* and fund performance more clearly.<sup>9</sup>

The first two columns of Table 7 present the after-expenses and the next two columns the before-expenses unconditional and conditional alphas for *Main\_Inv* deciles. The results in all the four columns are fairly consistent, namely that the alphas are higher in the deciles of funds with higher levels of *Main\_Inv*. The monthly abnormal returns in the tenth decile are, on average, greater by 12.2 to 21 basis points than the alphas of funds in the first decile and except for the case of the unconditional alpha after expenses these differences are statistically significant. The differences between the alphas of the 10<sup>th</sup> and the 5<sup>th</sup> deciles show similar patterns.

The last four columns of the table report the results from a similar analysis when we sort funds on the basis on *Rel\_Inv*, the level of investment in related industries. The abnormal performance of funds in the tenth decile is greater than that of funds in the first decile, but statistically insignificant. For example, funds in the tenth decile outperform funds in the first decile by 8 to 9.6 basis points. It is likely that for many of the funds in the 1<sup>st</sup> decile, the low level of *Rel\_Inv* is due to their having high levels of *Main\_Inv*. For these funds, the effect of low *Rel\_inv* is offset by the effect of high *Main\_Inv*. Funds in the 5<sup>th</sup> decile of *Rel\_Inv* are unlikely to suffer from such offsetting effects. The differences in the alphas of funds in the 10<sup>th</sup> and the 5<sup>th</sup> decile are indeed larger (around 20 basis points) and statistically significant.

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<sup>9</sup> We also conduct double sorting (quintile by quintile, both conditional and unconditional) and find similar. Because the number of quarterly observations in the earlier sample period is too small, there are not always sufficient numbers of funds for effective double sorting.

Next, we investigate the importance of main and related industry investments in determining fund performance in a multivariate setting by estimating OLS regressions with unconditional and conditional abnormal returns as the dependent variables and report the results in Table 8. The dependent variables are the difference between a fund's realized return in a quarter and the estimated expected return, which is calculated by using the estimated coefficients of the unconditional and conditional factor models on 3 years of past returns. We estimate three OLS specifications, the first with only *Main\_Inv*, the second with only *Rel\_Inv*, and the third with both *Main\_Inv* and *Rel\_Inv* as independent variables. In addition to these variables, as in Kacperczyk, Sialm, and Zheng (2005), each specification includes standard control variables such as fund age, fund size, fund expense and turnover ratios, inflows, and dummy variables for Aggressive Growth and Growth objectives. Each regression also includes year dummies and uses clustering and heteroskedasticity robust standard errors.

The first two columns of the table present the results for the specification with *Main\_Inv* and control variables as independent variables. The coefficient on *Main\_Inv* is positive and statistically significant for both unconditional and conditional abnormal return regressions, which is consistent with Kacperczyk, Sialm, and Zheng (2005) finding of a positive relation between performance and investment concentration. The next two columns present the findings from the specification with *Rel\_Inv* and control variables as independent variables. The coefficient on *Rel\_Inv* is positive and statistically significant in both unconditional and conditional alpha regressions. The coefficients on the control variables are quite similar to those for the first specification. The last two columns of the table present the results when we estimate the OLS regression that includes both *Main\_Inv* and *Rel\_Inv* along with the control variables. The coefficients on *Main\_Inv* in this specification are statistically insignificant for both

unconditional and conditional alphas abnormal returns. The coefficients on *Rel\_Inv*, on the other hand, remain significantly positive and of almost the same magnitude as in the previous specification with only *Rel\_Inv*. Our results using fund return-based measures, thus, offer mixed evidence for level of main industry investments as a determinant of fund performance. The evidence to support a positive relation between the level of investment in related industries and fund performance is, on the other hand, strong.

#### **4.2 Holding-based Performance Measures**

We present findings from the analysis using holding-based measures of fund performance in Table 9. As in the previous subsection, we sort funds into decile portfolios according to *Main\_Inv* and *Rel\_Inv* and compute the values for selection and timing measures *CS* and *CT*, respectively. The first two columns present *CS* and *CT* measures for *Main\_Inv* deciles and the last two columns for *Rel\_Inv* deciles. The selection measure *CS* shows a significant increase of 0.372 from the first to the tenth decile for portfolios formed on the basis of levels related investments, but an insignificant increase of 0.319 for portfolios formed on the basis of the main investment. The timing measure *CT* for main or related investment sorts have the opposite signs but both are insignificant. The difference between the 10th decile and the 5<sup>th</sup> decile show similar results. The difference between the 10<sup>th</sup> decile and the 4<sup>th</sup> decile is larger and more significant.

We then investigate the relation between main and related industry investment levels and holding-based fund performance measures *CS* and *CT* using multivariate OLS regressions, with year dummies and controlling for clustering and heteroskedasticity. For both *CS* and *CT* we again estimate three OLS specifications—with only *Main\_Inv*, with only *Rel\_Inv*, and with both *Main\_Inv* and *Rel\_Inv*. In each specification, we include the control variables described in the previous subsection. We report the results from estimating the regressions in Table 10. The first

three columns of the table present the findings for the selection ability variable *CS* and the last three columns report the results for the timing variable *CT*.

The results for stock selection mirror those for the return-based performance measures. The coefficient on *Main\_Inv* in the first column of Table 10 and the coefficient on *Rel\_Inv* in the second column are both positive and statistically significant, suggesting both *Main\_Inv* and *Rel\_Inv* are positively related to stock selection ability. However, when both *Main\_Inv* and *Rel\_Inv* are included in the specification, the coefficient on *Main\_Inv* is no longer statistically significant, but the coefficient on *Rel\_Inv* remains significantly positive and of virtually the same magnitude as that in the previous column. Therefore, it appears that the level of investment in related industry stocks is a better determinant of stock selection than *Main\_Inv*. A potential explanation is that a manager, for reasons related to price pressure and/or hubris, is less likely to change a fund's main investment on the basis of information. He/she, however, has more freedom to act on this information with respect to stocks in related industries. Therefore, a manager's stock selection ability is manifest primarily in the selection of stocks in related industries.

The previous table (Table 9) showed that sorting funds on the basis of *Main\_Inv* and *Rel\_Inv* did not yield any significant findings with respect to the timing ability of fund managers. However, the results from the multivariate regression analysis in the last three columns of Table 10 offer interesting insights into the relation between timing ability and investments in main and related industries. All the three specifications tell a consistent story—timing relates significantly *negatively* to *Main\_Inv* and significantly *positively* to *Rel\_Inv*. As we have argued before, when a fund makes a large investment in any one industry, it is a decision that may be relatively difficult to reverse. Such an investment may also reduce the manager's flexibility in reallocating

the investment portfolio. These issues become more binding as the level of investment in that one industry increases, which leads to a negative relation between *Main\_Inv* and *CT*. On the other hand, *Rel\_Inv* refers to investment in a set of stocks in as many as ten industries. Further, while we define related industries to include the top five supplier and five customer industries, we rarely find funds investing in all ten industries at any one time. As we show in Table 2, the median number of related industries in fund portfolios is two. As such, investments in related industries offer managers the flexibility to shift investments across industries. Thus, managers with timing ability are more likely to exhibit it in their related investments suggesting a positive relation between *Rel\_Inv* and *CT*.<sup>10</sup>

The results in this section show a positive relation between return-based and holding-based fund performance measures and investment levels in both main and related industries. The results are especially strong for levels of investment in related industries. These findings offer significant support for the hypothesis that investments in related industries may be good measures of the ability and/or effort of a fund manager. A manager with higher ability or one who expends more effort is more likely to detect the industry related information arising from product market supplier-customer relations. As a result of better using this information, investments in the related industries increase. Higher levels of investments in related industries, therefore, are more likely to be observed in funds with better ability or harder working managers.

## **5. Robustness Checks**

In this section, we conduct robustness checks on our main findings along several lines, including subsample results, alternative measure of industry relatedness, and a separate

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<sup>10</sup> Jiang, Yao, and Yu (2007) find evidence consistent with timing ability on the part of managers of equity funds. They show that timing ability is related to the manager's private information. The authors also show that large funds, with greater industry concentration, and a preference for small-cap stocks are more likely to exhibit timing.

examination of investments in related supplier and customer industries.

We split the sample period into two sub-periods, 1980-1994 and 1995-2006. In the first sub-period, firms are put into industry classifications based on historical SIC codes; while in the second sub-period firms are classified into different industries based on the NAICS codes.<sup>11</sup> Panel A of Table 11 shows that the dependence of related investment on the main investment is stronger in the 1995-2006 sub-period (0.068, significant at 1% level) than in the 1980-1994 sub-period (0.017, insignificant). The coefficient of the interaction term is the opposite, larger in the 1980-1994 sub-period than in the 1995-2006 sub-period, but both are statistically significant. The sub-sample difference may be because the finer NAICS classification better captures product market interrelations or may be due to mutual funds' paying more attention to product market information in the recent years than in the earlier years. In panel A we also examine whether the alternative measure of industry relatedness affects the dependence of related investment on the main industry. When we use the equal-weighted *INDREL*, the results are almost the same as what we reported in Table 3 with the value-weighted *INDREL*. Panel B of Table 11 presents results on supplier industries and customer industries separately. We can see that the level of main investment relates positively to related investments in both supplier and customer industries. However, while greater supplier relatedness makes the effect of main investment on related investments more positive in supplier industries, the effect of the degree of customer relatedness is statistically insignificant.

We next estimate the regressions for the relation between fund performance and investments in main and related industries for the two subsamples covering periods 1980-1994 and 1995-2006, respectively. The results presented in Panel A of Table 12 show that in the sub-

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<sup>11</sup> BEA published SIC-IO bridge tables for 1982, 1987 and 1992 IO tables and NAICS-IO bridge tables for 1997 and 2002 IO tables.

period 1980-1994, investment in the main industry has almost no effect on either return-based measures or holding-based performance measures, while investment in related industries has significantly positive effect on unconditional and conditional alphas but no effect on holding based performance measures. Panel B shows that in the sub-period 1995-2006, the effect of investment in related industries is stronger on each of the four performance measures, suggesting that fund managers make better use of product market information in more recent years than earlier years. The results are consistent with the sub-sample results on determinants of related investments reported in Panel A, Table 11. In panel C, we present the results from separately examining the effect of related investments in supplier and customer industries. The level of related investment in supplier industries relates positively to all four measures of fund performance. In the case of customer industries, the coefficients on related investment are positive for both measures of return-based performance but statistically significant only for the stock-selection measure.

## **6. Concluding Remarks**

In this paper we examine whether mutual fund investments reflect information related to product markets. We focus on a specific aspect of product market information, namely, the scope of the interrelatedness between an industry and its supplier and customer industries. We investigate mutual funds' investments in the main industry (the industry where funds invest the largest amount of money) and those in related industries (the important supplier and customer industries of the main industry). Our findings from a large sample of equity mutual fund holdings data show that compared with the market average, fund managers invest significantly more in the main industry and the related industries. In addition, their investments in related industries are greater when the investments in the main industry are greater and when the degree

of interrelatedness between the main industry and its supplier/customer industries is greater. Our analysis of the trading in main and related industry stocks reveals that when fund trades are more likely driven by information, that is, buys when there is net outflow and sells when there is net inflow, a larger proportion of these trades are in stocks of the main and related industries, particularly related industries. Finally, we examine the relation between main and related investments and fund performance, using both return-based and holding-based measures of fund performance. We find that portfolios of funds with higher investments in the main industry or the related industries generate higher returns. Multivariate regression analysis, however, shows that only the level of investments in related industries is significantly positively related to abnormal fund returns. Using holding-based performance measures, multivariate regression tests of the selectivity measures again show that the positive relation exists only with the level of investment in related industry stocks. In addition, regression results indicate that related investment relates positively while main investment relates negatively with timing ability.

All our findings indicate that mutual fund managers make use of information arising from product market linkages in making investment decisions. We also provide strong evidence of a positive relation between fund performance and levels of investment in main and related industries. Producing information is costly in terms of money and/or effort and therefore higher levels of investment in main and related industry stocks indicate that managers selectively concentrate on stocks where they have information advantage. Our results, therefore, indicate that many mutual fund managers do have ability and that they do exert effort.

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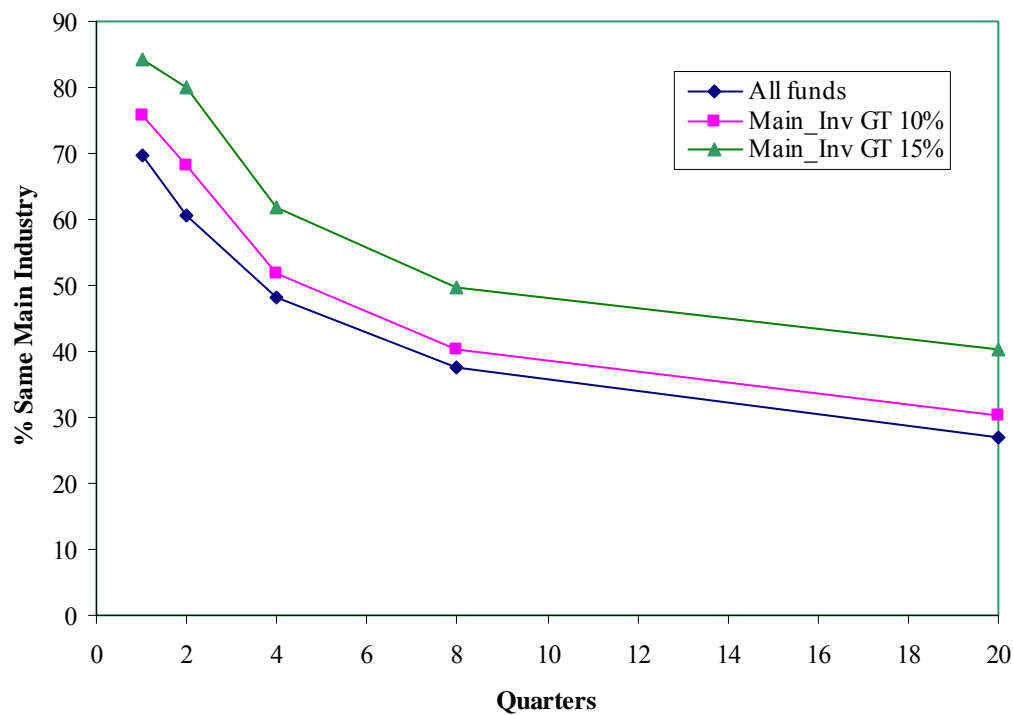
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**Figure 1**

The sample consists of all mutual funds in the Thomson/CDA holdings database and CRSP mutual fund database for which data are available for the period from 1980 to 2006 and does not include index funds, funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. Industries are defined according to the classification in the Bureau of Economic Analysis Benchmark Input-Output Tables. *Main Industry* is the industry in which a fund has the highest % level of investment. The variable *Main\_Inv* equals investment in the *Main industry* divided by *Total Assets*. This figure shows the percentage of funds whose main industry in quarter  $t$  remains to be the main industry in quarter  $t+q$ , with  $q$  equal to one quarter, two quarters, four quarters (one year), eight quarters (two years), and twenty quarters (five years). From the top to the bottom, the plots are for funds with at least 15% in the main industry, with at least 10% in the main industry, and all funds in the sample at the end of quarter  $t$ .



**Table 1****Summary Statistics of the Characteristics of Mutual Funds in the Sample**

The sample consists of all mutual funds in the Thomson/CDA holdings database and CRSP mutual fund database for which data are available for the period from 1980 to 2006 and does not include index funds, funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. Industries are defined according to the classification in the Bureau of Economic Analysis Benchmark Input-Output Tables. The sample consists of 1951 (54,862) funds (fund-quarters).

Variable	Mean	Median	Minimum	Maximum
Total Fund Net Assets (\$M)	1,196.980	226.600	1.000	161,911
Age of Fund (years)	16.722	11.417	1	83.583
# Industries / fund	41.131	35	3	351
# Stocks / fund	92.580	63	10	3,439
Fund Expense Ratio (%)	1.278	1.200	0.02	14.780
Fund Turnover Ratio (%)	86.022	65.000	0.040	4,262
Inflow (%) (winsorized)	2.023	-0.453	-27.50	69.60

**Table 2****Summary Statistics of Holdings in Main and Related Industries**

The sample consists of all mutual funds in the Thomson/CDA holdings database and CRSP mutual fund database for which data are available for the period from 1980 to 2006 and does not include index funds, funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. Industries are defined according to the classification in the Bureau of Economic Analysis Benchmark Input-Output Tables. *Main Industry* is the industry in which a fund has the highest % level of investment. *Related Industries* are the five main supplier industries and five main customer industries according to the I/O Tables. The variable *Main\_Inv* equals investment in the *Main industry* divided by *Total Assets*; *Rel\_Inv* equals investment in the *Related Industries* divided by *Total Assets*; The variables *Ave\_Rel\_Inv* and *Ave\_NonRel\_Inv* equal average investments in each of the *Related* and *Non-Related Industries*, respectively. The variables *Ex\_Main\_Inv* and *Ex\_Rel\_Inv* are average excess investments in an industry when it is the *Main Industry* and the *Related Industries* vis a vis when it is not, respectively. The variable *%Top\_Rel\_Ind* equals the percentage of *Related Industries* with above median portfolio weight. *INDREL* equals the market-cap-weighted average of relatedness (\$ of inputs of the five most related supplier industries for every one dollar output of the main industry and \$ of inputs of the main industries for every one dollar output of the five most related customer industry from the I/O tables). The sample consists of 1951 (54,862) funds (fund-quarters).

## Panel A. Main and Related Industry Holdings: All Funds

Variable	Mean	Median	Minimum	Maximum
Main_Inv (%)	14.918	12.839	3.184	49.996
# Stocks in Main Industry	9.082	7	1	342
Rel_Inv (%)	7.980	6.453	0	63.469
# Related Industries	2.667	2	0	10
# Stocks in Related Industries	8.867	5	0	369
Ave_Rel_Inv (%)	3.491	2.858	8.226E-6	38.146
Ave_NonRel_Inv (%)	2.680	2.407	0.234	42.567
Ex_Main_Inv (%)	10.143	8.061	-3.750	49.110
Ex_Rel_Inv (%)	1.571	0.249	-15.544	55.318
%Top_Rel_Ind	64.303	66.667	0	100
INDREL	0.087	0.056	0.007	0.594

*Continued*

**Table 2 (Continued)**

## Panel B. Main and Related Industry Holdings by Fund Investment Objective

Variables	Fund Investment Objective		
	Aggressive Growth	Growth	Income
Main_Inv (%)	16.705	14.708	14.364
Rel_Inv (%)	9.489	7.877	7.309
INDREL	0.075	0.085	0.102

**Table 3****GMM Regression Results on Determinants of Related Investment**

The sample consists of all mutual funds in the Thomson/CDA holdings database and CRSP mutual fund database for which data are available for the period from 1980 to 2006 and does not include index funds, funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. Industries are defined according to the classification in the Bureau of Economic Analysis Input Output (IO) Tables. *Main Industry* is the industry in which a fund has the highest % level of investment. *Related Industries* are the five main supplier industries and five main customer industries according to the I/O Tables. The dependent variable is *Rel\_Inv* which equals investment in the *Related Industries* divided by *Total Assets*. The independent variables are: *Main\_Inv* equals investment in the *Main industry* divided by *Total Assets*; *INDREL* equals the market-cap-weighted average of relatedness (\$ of inputs of the five most related supplier industries for every one dollar output of the main industry and \$ of inputs of the main industries for every one dollar output of the five most related customer industry from the I/O tables); and *Main\_ih /Rel\_ih* is the average institutional holding of the stocks belonging to the *Main / Related* industries. Heteroskedasticity robust standard errors are in parentheses. The symbols <sup>\*\*\*</sup>, <sup>\*\*</sup>, and <sup>\*</sup> denote significance at the 1%, 5%, and 10%, respectively.

Dependent Variable →	First Stage		GMM	
	Main_Inv	INDREL* Main_Inv	Rel_Inv	Rel_Inv
Intercept	3.062 <sup>***</sup> (0.47)	-0.194 <sup>***</sup> (0.05)	0.616 <sup>**</sup> (0.26)	0.949 <sup>***</sup> (0.26)
Main_Inv			0.073 <sup>***</sup> (0.01)	0.057 <sup>***</sup> (0.01)
INDREL	-1.468 (1.28)	4.490 <sup>***</sup> (0.42)		-2.37 <sup>***</sup> (0.767)
INDREL*Main_Inv				0.163 <sup>***</sup> (0.05)
Lagged Rel_Inv	0.100 <sup>***</sup> (0.01)	0.012 <sup>***</sup> (0.00)	0.839 <sup>***</sup> (0.01)	0.837 <sup>***</sup> (0.01)
Rel_ih	3.589 <sup>***</sup> (0.69)	-0.060 (0.09)	-3.43 <sup>***</sup> (0.40)	-3.462 <sup>***</sup> (0.42)
Ln(Fund Age)	-0.016 (0.05)	0.003 (0.01)	-0.061 <sup>***</sup> (0.02)	-0.061 <sup>***</sup> (0.02)
Ln(Fund Total Net Assets)	-0.055 <sup>**</sup> (0.02)	-0.004 (0.003)	0.039 <sup>***</sup> (0.01)	0.040 <sup>***</sup> (0.01)
Fund Expense Ratio	0.703 <sup>***</sup> (0.09)	0.067 <sup>***</sup> (0.01)	-0.057 (0.05)	-0.055 (0.05)
Fund Turnover	0.400 <sup>***</sup> (0.09)	0.036 <sup>***</sup> (0.01)	0.002 (0.03)	0.003 (0.03)

*Continued*

**Table 3 (Continued)**

Dependent Variable →	First Stage		GMM	
	Main_Inv	INDREL* Main_Inv	Rel_Inv	Rel_Inv
Inflow	0.003* (0.002)	0.001** (0.00)	0.001 (0.001)	0.0003 (0.001)
Dummy (Aggr. Growth)	0.558*** (0.14)	0.090*** (0.02)	0.170*** (0.06)	0.163*** (0.06)
Dummy (Growth)	0.134* (0.09)	0.046*** (0.01)	0.046 (0.04)	0.032 (0.04)
Lagged Main_Inv	0.717*** (0.01)	-0.004*** (0.001)		
Main_ih	-0.502 (0.44)	0.129* (0.07)		
INDREL*Lagged Main_Inv	-0.038 (0.06)	0.758*** (0.02)		
INDREL*Main_ih	10.613*** (2.39)	1.923** (0.83)		
Year Dummies	Yes	Yes	Yes	Yes
Adj-R <sup>2</sup>	0.68	0.90		
# of Observations	50,217	50,217	50,217	50,217
# of clusters	1,913	1,913	1,913	1,913
GMM C-Statistic ( $\chi^2$ )			131.037***	135.784***
Shea Partial R <sup>2</sup>	0.65	0.69		
F-Statistic	1880.09***	1659.23***		
Hansen J-Statistic(p-value)			0.23	0.18

**Table 4****Summary Statistics of Trading in Main and Related Industries**

The sample consists of all mutual funds in the Thomson/CDA holdings database and CRSP mutual fund database for which data are available for the period from 1980 to 2006 and does not include index funds, funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. Industries are defined according to the classification in the Bureau of Economic Analysis Input Output Tables. *Main Industry* is the industry in which a fund has the highest % level of investment. *Related Industries* are the five main supplier industries and five main customer industries according to the I/O Tables. The variable *Total\_Buy* (*Total\_Sell*) equals \$s used (received) in purchasing (from selling) all stocks; *Main\_Buy* (*Main\_Sell*) equals \$s used (received) in purchasing (from selling) stocks in *Main Industry*; *Rel\_Buy* (*Rel\_Sell*) equals \$s used (received) in purchasing (from selling) stocks in the *Related Industries*; %*Main\_Buy* equals *Main\_Buy* / *Total\_Buy*; %*Main\_Sell* equals *Main\_Sell* / *Total\_Sell*; %*Rel\_Buy* equals *Rel\_Buy* / *Total\_Buy*; and %*Rel\_Sell* equals *Rel\_Sell* / *Total\_Sell*. The sample consists of 1951 (54,862) funds (fund-quarters).

Variables	All	Fund Investment Objective		
		Aggressive Growth	Growth	Income
Total_Buy (\$M)	146.203	155.317	133.470	174.993
Total_Sell (\$M)	77.553	81.876	68.059	100.578
Main_Buy (\$M)	17.125	22.711	15.064	19.193
Main_Sell (\$M)	9.717	13.279	8.013	12.093
Rel_Buy (\$M)	12.660	16.599	11.470	13.403
Rel_Sell (\$M)	5.941	7.181	5.050	7.577
%Main_Buy (%)	12.297	14.810	12.071	11.310
%Main_Sell (%)	13.685	16.047	13.583	12.436
%Rel_Buy (%)	8.122	10.017	8.001	7.241
%Rel_Sell (%)	7.901	9.564	7.793	7.117

**Table 5****Correlations among Fund Flows, Total Trades, and Trades in Main and Related Industries**

The sample consists of all mutual funds in the Thomson/CDA holdings database and CRSP mutual fund database for which data are available for the period from 1980 to 2006 and does not include index funds, funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. Industries are defined according to the classification in the Bureau of Economic Analysis Input Output Tables. *Main Industry* is the industry in which a fund has the highest % level of investment. *Related Industries* are the five main supplier industries and five main customer industries the I/O Tables. The variables %*Total\_Buy* and %*Total\_Sell* are ratios of the total buys and total sales in a quarter to total fund assets; %*Main\_Buy* (%*Main\_Sell*) equals \$s used (received) in buying (from selling) *Main Industry* stocks divided by *Total\_Buy* (*Total\_Sell*); and %*Rel\_Buy* (%*Rel\_Sell*) equals \$s used (received) in buying (from selling) *Related Industry* stocks divided by *Total\_Buy* (*Total\_Sell*). We sort funds into two groups based on net inflows (Panel A) and net outflows (Panel B) and then calculate correlations within each group. The symbols <sup>\*\*\*</sup>, <sup>\*\*</sup>, and <sup>\*</sup> denote significance at the 1%, 5%, and 10%, respectively.

**Panel A. When mutual funds have a net inflow of funds**

	Inflow(%)	%Total_Buy	%Total_Sell	%Main_Buy	%Main_Sell	%Rel_buy
%Total_Buy	0.476 <sup>***</sup>	1.000				
%Total_Sell	-0.043 <sup>***</sup>	0.030 <sup>***</sup>	1.000			
%Main_Buy	0.050 <sup>***</sup>	0.060 <sup>***</sup>	-0.023 <sup>***</sup>	1.000		
%Main_Sell	0.023 <sup>***</sup>	0.012 <sup>*</sup>	0.066 <sup>***</sup>	0.042 <sup>***</sup>	1.000	
%Rel_Buy	0.034 <sup>***</sup>	0.051 <sup>***</sup>	0.026 <sup>***</sup>	-0.027 <sup>***</sup>	0.079 <sup>***</sup>	1.000
%Rel_Sell	0.019 <sup>***</sup>	0.039 <sup>***</sup>	0.028 <sup>***</sup>	0.076 <sup>***</sup>	-0.070 <sup>***</sup>	0.192 <sup>***</sup>

**Panel B. When mutual funds have a net outflow of funds**

	Outflow(%)	%Total_Buy	%Total_Sell	%Main_Buy	%Main_Sell	%Rel_buy
%Total_Buy	-0.070 <sup>***</sup>	1.000				
%Total_Sell	0.269 <sup>***</sup>	0.086 <sup>***</sup>	1.000			
%Main_Buy	-0.011 <sup>*</sup>	0.042 <sup>***</sup>	-0.037 <sup>***</sup>	1.000		
%Main_Sell	0.018 <sup>***</sup>	0.013 <sup>**</sup>	0.019 <sup>***</sup>	0.072 <sup>***</sup>	1.000	
%Rel_Buy	0.027 <sup>***</sup>	0.022 <sup>***</sup>	0.009	-0.037 <sup>***</sup>	0.091 <sup>***</sup>	1.000
%Rel_Sell	0.008	0.015 <sup>**</sup>	0.012 <sup>**</sup>	0.099 <sup>***</sup>	-0.037 <sup>***</sup>	0.196 <sup>***</sup>

**Table 6****Trading in Main and Related Industry Stocks when Funds have Net Inflows or Net Outflows**

The sample consists of all mutual funds in the Thomson/CDA holdings database and CRSP mutual fund database for which data are available for the period from 1980 to 2006 and does not include index funds, funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. *Main Industry* is the industry in which a fund has the highest % level of investment. *Related Industries* are the five main supplier industries and five main customer industries the I/O Tables. The variables *Total\_Buy/Total Assets* and *Total\_Sell/Total Assets* are ratios of the total buys and total sales in a quarter to total fund assets; *%Main\_Buy* (*%Main\_Sell*) equals \$s used (received) in buying (from selling) *Main Industry* stocks divided by *Total\_Buy* (*Total\_Sell*); and *%Rel\_Buy* (*%Rel\_Sell*) equals \$s used (received) in buying (from selling) *Related Industry* stocks divided by *Total\_Buy* (*Total\_Sell*). Every quarter we sort funds into quintiles based on net inflows (Panel A) and net outflows (Panel B). Then we calculate the equal-weighted averages of all the variables. The table shows the time series average statistics from 1980 to 2006. Standard errors are in parentheses. In the last row of both panels, we report the % change in average values from Quintiles 1 and 5 in square brackets. The symbols <sup>\*\*\*</sup>, <sup>\*\*</sup>, and <sup>\*</sup> denote significance at the 1%, 5%, and 10%, respectively.

## Panel A. When mutual funds have a net inflow of funds

Quintile	Inflow (%)	Total_Buy / Total Assets	%Main_Buy	%Rel_Buy	Total_Sell / Total Assets	%Main_Sell	%Rel_Sell
1	1.186 <sup>***</sup> (0.12)	11.779 <sup>***</sup> (0.44)	12.118 <sup>***</sup> (0.33)	7.910 <sup>***</sup> (0.27)	6.710 <sup>***</sup> (0.21)	13.392 <sup>***</sup> (0.36)	7.627 <sup>***</sup> (0.32)
2	3.248 <sup>***</sup> (0.23)	12.839 <sup>***</sup> (0.43)	12.069 <sup>***</sup> (0.49)	7.895 <sup>***</sup> (0.30)	6.205 <sup>***</sup> (0.18)	13.400 <sup>***</sup> (0.43)	8.026 <sup>***</sup> (0.38)
3	5.817 <sup>***</sup> (0.26)	14.915 <sup>***</sup> (0.54)	12.355 <sup>***</sup> (0.44)	7.800 <sup>***</sup> (0.36)	6.186 <sup>***</sup> (0.18)	13.580 <sup>***</sup> (0.54)	6.928 <sup>***</sup> (0.33)
4	10.196 <sup>***</sup> (0.32)	17.616 <sup>***</sup> (0.58)	12.415 <sup>***</sup> (0.30)	8.107 <sup>***</sup> (0.29)	5.800 <sup>***</sup> (0.19)	13.384 <sup>***</sup> (0.45)	8.019 <sup>***</sup> (0.47)
5	32.171 <sup>***</sup> (1.24)	30.631 <sup>***</sup> (1.11)	14.027 <sup>***</sup> (0.35)	8.469 <sup>***</sup> (0.29)	5.416 <sup>***</sup> (0.18)	14.372 <sup>***</sup> (0.55)	8.623 <sup>***</sup> (0.48)
5th-1st Quintile [%Chg.]	30.985 <sup>***</sup> (1.23)	18.852 <sup>***</sup> (0.83) [160.04]	1.909 <sup>***</sup> (0.47) [15.75]	0.559 <sup>*</sup> (0.32) [7.07]	-1.294 <sup>***</sup> (0.21) [-19.28]	0.980 (0.63) [7.00]	0.996 <sup>**</sup> (0.50) [13.06]

*Continued*

**Table 6 (Continued)**

Panel B. When mutual funds have a net outflow of funds

Quintile	Outflow (%)	Total_Buy / Total Assets	%Main_Buy	%Rel_Buy	Total_Sell / Total Assets	%Main_Sell	%Rel_Sell
1	1.003*** (0.16)	11.533*** (0.49)	11.579** (0.38)	7.439*** (0.30)	7.144*** (0.25)	13.408*** (0.46)	7.294*** (0.30)
2	2.638*** (0.29)	10.865*** (0.41)	13.213*** (1.03)	7.229*** (0.35)	7.471*** (0.28)	14.854*** (0.97)	7.917*** (0.51)
3	4.374*** (0.39)	10.240*** (0.36)	12.851** (0.44)	7.792*** (0.35)	8.564*** (0.29)	13.380*** (0.58)	7.218*** (0.35)
4	6.613*** (0.45)	10.415*** (0.34)	12.612*** (0.49)	7.781*** (0.40)	9.422*** (0.32)	14.095*** (0.47)	7.956*** (0.49)
5	15.316*** (0.64)	9.562*** (0.35)	12.766*** (0.78)	8.179*** (0.35)	12.534*** (0.522)	15.844*** (0.93)	8.164*** (0.50)
5th-1st Quintile [%Chg.]	14.313*** (0.57)	-1.971*** (0.49) [-17.06]	1.186 (0.90) [10.24]	0.741* (0.42) [9.96]	5.390*** (0.45) [75.45]	2.436** (1.15) [18.17]	0.870 (0.53) [11.93]

**Table 7****Portfolio 4-Factor Model Abnormal Returns and Levels of Main and Related Investment**

The sample consists of all mutual funds in the Thomson/CDA holdings database and CRSP mutual fund database for which data are available for the period from 1980 to 2006 and does not include index funds, funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. *Main Industry* is the industry in which a fund has the highest % level of investment. *Related Industries* are the five main supplier industries and five main customer industries according to the I/O Tables. The variable *Main\_Inv* equals investment in the *Main industry* divided by *Total Assets* and *Rel\_Inv* equals investment in the *Related Industries* divided by *Total Assets*. The table presents monthly unconditional and conditional abnormal returns using the Carhart (1997) 4-factor model and the Ferson and Schadt (1996) model, respectively. For every quarter during the period 1980 – 2006, we sort mutual funds into decile portfolios according to their *Main\_Inv* and *Rel\_Inv*, respectively, and for each decile compute the monthly unconditional and conditional four-factor model alphas. Standard errors are in parentheses. The symbols <sup>\*\*\*</sup>, <sup>\*\*</sup>, and <sup>\*</sup> denote significance at the 1%, 5%, and 10%, respectively.

Decile	Main_Inv				Rel_Inv			
	After Exp.		Before Exp.		After Exp.		Before Exp.	
	Uncond.	Cond.	Uncond.	Cond.	Uncond.	Cond.	Uncond.	Cond.
1	-0.070 (0.07)	-0.100* (0.06)	0.023 (0.05)	-0.006 (0.06)	-0.009 (0.05)	-0.034 (0.05)	0.091* (0.05)	0.067 (0.05)
2	-0.066 (0.05)	-0.101* (0.05)	0.022 (0.05)	-0.012 (0.05)	-0.093* (0.05)	-0.102* (0.07)	-0.005 (0.05)	-0.013 (0.05)
3	-0.078 (0.05)	-0.112** (0.05)	0.019 (0.05)	-0.014 (0.05)	-0.62 (0.05)	-0.068 (0.05)	0.033 (0.05)	-0.028 (0.05)
4	-0.076 (0.05)	-0.106** (0.05)	0.020 (0.05)	-0.010 (0.05)	-0.100* (0.05)	-0.104** (0.05)	-0.003 (0.05)	-0.007 (0.05)
5	-0.048 (0.05)	-0.088* (0.05)	0.052 (0.05)	0.012 (0.05)	-0.107** (0.05)	-0.123** (0.05)	-0.014 (0.05)	-0.030 (0.05)
6	-0.089 (0.05)	-0.085* (0.05)	0.008 (0.05)	0.012 (0.05)	-0.088* (0.05)	-0.104** (0.05)	0.006 (0.05)	-0.010 (0.05)
7	-0.028 (0.05)	-0.049 (0.05)	0.066 (0.05)	0.045 (0.05)	-0.049 (0.05)	-0.063 (0.05)	0.050 (0.05)	0.036 (0.05)
8	-0.010 (0.05)	-0.010 (0.05)	0.086* (0.05)	0.086* (0.05)	-0.046 (0.05)	-0.062 (0.05)	0.050 (0.05)	0.036 (0.05)
9	0.013 (0.05)	0.012 (0.05)	0.112** (0.05)	0.113** (0.07)	-0.007 (0.06)	-0.025 (0.05)	0.093* (0.06)	0.075 (0.06)
10	0.052 (0.07)	0.093 (0.07)	0.162** (0.07)	0.204*** (0.09)	0.087 (0.07)	0.055 (0.05)	0.194*** (0.07)	0.162** (0.08)
10 <sup>th</sup> -1 <sup>st</sup> Decile	0.122 (0.08)	0.193** (0.08)	0.138* (0.08)	0.210*** (0.08)	0.096 (0.08)	0.089 (0.08)	0.080 (0.08)	0.095 (0.08)
10 <sup>h</sup> -5 <sup>st</sup> Decile	0.100 (0.08)	0.181** (0.08)	0.110* (0.08)	0.192** (0.08)	0.194*** (0.08)	0.178** (0.08)	0.208*** (0.08)	0.192** (0.08)

**Table 8****Main Investment and Relative Investment as Determinants of Abnormal Returns: OLS Results**

The sample consists of all mutual funds in the Thomson/CDA holdings database and CRSP mutual fund database for which data are available for the period from 1980 to 2006 and does not include index funds, funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. *Main Industry* is the industry in which a fund has the highest % level of investment. *Related Industries* are the five main supplier industries and five main customer industries according to the I/O Tables. The variable *Main\_Inv* equals investment in the *Main industry* divided by *Total Assets* and *Rel\_Inv* equals investment in the *Related Industries* divided by *Total Assets*. The dependent variables are unconditional abnormal returns using the Carhart (1997) four-factor model and the conditional abnormal returns using the Ferson and Schadt (1996) model based on 3 years of lagged data. Heteroskedasticity robust standard errors are in parentheses. The symbols <sup>\*\*\*</sup>, <sup>\*\*</sup>, and <sup>\*</sup> denote significance at the 1%, 5%, and 10%, respectively.

	Four-Factor Abnormal Return					
	<u>Uncond.</u>	<u>Cond.</u>	<u>Uncond.</u>	<u>Cond.</u>	<u>Uncond.</u>	<u>Cond.</u>
Intercept	0.146 (0.22)	0.167 (0.22)	-0.344 <sup>*</sup> (0.21)	0.045 (0.02)	-0.301 (0.22)	0.047 (0.23)
Main_Inv	0.008 <sup>*</sup> (0.004)	0.009 <sup>**</sup> (0.005)			-0.004 (0.005)	-0.0001 (0.005)
Rel_Inv			0.049 <sup>***</sup> (0.005)	0.038 <sup>***</sup> (0.05)	0.050 <sup>***</sup> (0.005)	0.038 <sup>***</sup> (0.005)
Ln(Fund Age)	-0.104 <sup>***</sup> (0.04)	-0.124 <sup>***</sup> (0.04)	-0.091 <sup>**</sup> (0.04)	-0.114 <sup>***</sup> (0.04)	-0.091 <sup>**</sup> (0.04)	-0.114 <sup>***</sup> (0.04)
Ln(Net Assets)	-0.030 <sup>*</sup> (0.02)	-0.042 <sup>**</sup> (0.02)	-0.039 <sup>**</sup> (0.02)	-0.049 <sup>**</sup> (0.02)	-0.039 <sup>**</sup> (0.02)	-0.049 <sup>**</sup> (0.02)
Exp_ratio	-0.124 <sup>*</sup> (0.07)	-0.133 <sup>*</sup> (0.04)	-0.141 <sup>**</sup> (0.07)	-0.141 <sup>*</sup> (0.07)	0.134 <sup>**</sup> (0.07)	-0.141 <sup>*</sup> (0.07)
Turn_ratio	0.126 <sup>**</sup> (0.06)	0.129 <sup>**</sup> (0.06)	0.114 <sup>*</sup> (0.06)	0.120 <sup>*</sup> (0.06)	0.114 <sup>*</sup> (0.06)	0.120 <sup>*</sup> (0.06)
Pinflow	0.022 <sup>***</sup> (0.003)	0.015 <sup>***</sup> (0.003)	0.022 <sup>***</sup> (0.003)	0.014 <sup>***</sup> (0.003)	0.022 <sup>***</sup> (0.003)	0.014 <sup>***</sup> (0.003)
Dummy (AG)	0.908 <sup>***</sup> (0.09)	1.012 <sup>***</sup> (0.09)	0.822 <sup>***</sup> (0.09)	0.950 <sup>***</sup> (0.09)	0.828 <sup>***</sup> (0.09)	0.951 <sup>***</sup> (0.09)
Dummy (G)	0.396 <sup>***</sup> (0.05)	0.461 <sup>***</sup> (0.06)	0.383 <sup>***</sup> (0.05)	0.451 <sup>***</sup> (0.06)	0.383 <sup>***</sup> (0.05)	0.451 <sup>***</sup> (0.06)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
# Obs.	52,609	52,609	52,609	52,609	52,609	52,609
Adj-R <sup>2</sup> (%)	7.62	7.82	7.88	7.94	7.88	7.94

**Table 9****Portfolio Holding-Based Performance and Levels of Main and Related Investment**

The sample consists of all mutual funds in the Thomson/CDA holdings database and CRSP mutual fund database for which data are available for the period from 1980 to 2006 and does not include index funds, funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. *Main Industry* is the industry in which a fund has the highest % level of investment. *Related Industries* are the five main supplier industries and five main customer industries according to the I/O Tables. The variable *Main\_Inv* equals investment in the *Main industry* divided by *Total Assets* and *Rel\_Inv* equals investment in the *Related Industries* divided by *Total Assets*. The table presents holding-based performance measures of stock selection (*CS*) and timing (*CT*) using the Daniel, Grinblat, Titman, and Wermers (1997). Every quarter during the period 1980-2006, we sort mutual funds into decile portfolios according to their *Main\_Inv* and *Rel\_Inv*, respectively, and compute *CS* and *CT*. Standard errors are in parentheses. The symbols \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10%, respectively.

Deciles	Main_Inv		Rel_Inv	
	CS	CT	CS	CT
1	0.118 (0.10)	0.042 (0.06)	0.177* (0.10)	0.012 (0.07)
2	0.075 (0.09)	0.013 (0.07)	0.184 (0.14)	-0.024 (0.09)
3	0.138 (0.09)	0.030 (0.08)	0.106 (0.11)	0.004 (0.07)
4	0.193** (0.09)	-0.048 (0.08)	0.046 (0.10)	-0.066 (0.07)
5	0.149 (0.10)	0.087 (0.08)	0.152 (0.11)	-0.004 (0.07)
6	0.114 (0.11)	-0.028 (0.07)	0.124 (0.12)	-0.001 (0.07)
7	0.279** (0.12)	0.032 (0.08)	0.256** (0.11)	0.022 (0.09)
8	0.410** (0.16)	-0.020 (0.09)	0.288** (0.14)	0.036 (0.08)
9	0.399** (0.16)	-0.044 (0.10)	0.401** (0.16)	0.036 (0.09)
10	0.437** (0.22)	-0.007 (0.10)	0.549** (0.23)	0.031 (0.10)
10 <sup>th</sup> -1 <sup>st</sup> Decile	0.319 (0.24)	-0.049 (0.07)	0.372* (0.22)	0.018 (0.07)
10 <sup>th</sup> -5 <sup>th</sup> Decile	0.288 (0.21)	-0.094 (0.07)	0.397* (0.21)	0.035 (0.06)

**Table 10****OLS Regression of DGTW Performance Measures on Main and Related Investment**

The sample consists of all mutual funds in the Thomson/CDA holdings database and CRSP mutual fund database for which data are available for the period from 1980 to 2006 and does not include index funds, funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. *Main Industry* is the industry in which a fund has the highest % level of investment. *Related Industries* are the five main supplier industries and five main customer industries according to the I/O Tables. The variable *Main\_Inv* equals investment in the *Main industry* divided by *Total Assets* and *Rel\_Inv* equals investment in the *Related Industries* divided by *Total Assets*. The dependent variables are the holding-based performance measures of stock selection (*CS*) and timing (*CT*) using the Daniel, Grinblat, Titman, and Wermers (1997). Heteroskedasticity robust standard errors are in parentheses. The symbols <sup>\*\*\*</sup>, <sup>\*\*</sup>, and <sup>\*</sup> denote significance at the 1%, 5%, and 10%, respectively.

	DGTW Performance Measure					
	CS	CS	CS	CT	CT	CT
Intercept	-7.681 (18.66)	-12.513 (18.12)	-19.387 (18.74)	23.350 <sup>**</sup> (9.82)	13.292 (9.60)	21.24 <sup>**</sup> (9.84)
Main_Inv	1.602 <sup>***</sup> (0.39)		0.627 (0.42)	-0.432 <sup>**</sup> (0.17)		-0.652 <sup>***</sup> (0.18)
Rel_Inv		4.093 <sup>***</sup> (0.41)	3.928 <sup>***</sup> (0.44)		0.704 <sup>***</sup> (0.18)	0.879 <sup>***</sup> (0.18)
Ln(Fund Age)	1.930 (2.54)	3.014 (2.55)	3.032 (2.55)	0.280 (1.36)	0.562 (1.36)	0.561 (1.37)
Ln(Total Net Assets)	-4.214 <sup>***</sup> (1.24)	-4.880 <sup>***</sup> (1.25)	-4.874 <sup>***</sup> (1.25)	-0.337 (0.64)	-0.479 (0.63)	-0.477 (0.64)
Fund Expense Ratio	-11.26 <sup>**</sup> (5.04)	-11.281 <sup>**</sup> (5.08)	-12.234 <sup>**</sup> (5.03)	-3.869 (2.73)	-5.008 <sup>*</sup> (2.67)	-3.986 (2.73)
Fund Turnover Ratio	3.159 (3.96)	2.214 (3.85)	2.243 (3.86)	1.738 (2.11)	1.591 (2.10)	1.542 (2.09)
Inflow	1.116 <sup>***</sup> (0.19)	1.055 <sup>**</sup> (0.19)	1.052 <sup>***</sup> (0.19)	0.365 <sup>***</sup> (0.10)	0.350 <sup>***</sup> (0.10)	0.352 <sup>***</sup> (0.10)
Dummy(Aggr. Growth)	25.15 <sup>***</sup> (6.64)	19.86 <sup>***</sup> (6.61)	18.966 <sup>***</sup> (6.62)	2.989 (3.21)	0.603 (3.22)	1.541 (3.20)
Dummy (Growth)	0.525 (3.48)	-0.594 (3.45)	-0.562 (3.45)	0.251 (1.98)	0.110 (2.00)	0.019 (1.99)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
# Obs.	52,479	52,479	52,479	43,275	43,275	43,275
Adj-R <sup>2</sup> (%)	2.24	2.59	2.60	6.08	6.12	6.17

**Table 11****Robustness Check of Regression Results on Determinants of Related Investment**

The sample consists of all mutual funds in the Thomson/CDA holdings database and CRSP mutual fund database for which data are available for the period from 1980 to 2006 and does not include index funds, funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. Industries are defined according to the classification in the Bureau of Economic Analysis Input Output Tables. *Main Industry* is the industry in which a fund has the highest % level of investment. *Related Industries* are the five main supplier industries and five main customer industries according to the I/O Tables. The dependent variable is *Rel\_Inv* which equals investment in the *Related Industries* divided by *Total Assets*, and *Sup\_Inv* (*Cus\_Inv*), which equals investment in the five main suppliers (customers) divided by *Total Assets*. The independent variables are *Main\_Inv* which equals investment in the *Main industry* divided by *Total Assets*; *INDREL* which equals the market-cap-weighted average of relatedness (\$ of inputs of the five most related supplier industries for every one dollar output of the main industry and \$ of inputs of the main industries for every one dollar output of the five most related customer industry from the I/O tables); alternative *INDREL* which equals the equal-weighted average of relatedness; and *Sup\_Rel* (*Cus\_Rel*) which equals the market-cap-weighted average of relatedness of the five main supplier (customer) industries. Panel A reports the subsample results and the whole sample results with alternative *INDREL*. Panel B reports the results of separate regressions of investments in supplier and customer industries. Heteroskedasticity robust standard errors are in parentheses. The symbols <sup>\*\*\*</sup>, <sup>\*\*</sup>, and <sup>\*</sup> denote significance at the 1%, 5%, and 10%, respectively.

## Panel A. Robustness Check with Alternative INDREL and Subsamples

	Subsample 1995-2006	Subsample 1980-1994	Whole Sample Alternative INDREL
Dependent Variable →	Rel_Inv	Rel_Inv	Rel_Inv
Main_Inv	0.068 <sup>***</sup> (0.01)	0.017 (0.01)	0.052 <sup>***</sup> (0.01)
INDREL*Main_Inv	0.137 <sup>**</sup> (0.06)	0.328 <sup>**</sup> (0.17)	0.215 <sup>***</sup> (0.07)
INDREL	-2.010 <sup>**</sup> (0.81)	-3.994 <sup>*</sup> (2.39)	-3.129 <sup>***</sup> (1.05)
# of Observations	32761	13056	50217

*Continued*

**Table 11 (Continued)**

## Panel B. Robustness Check with Investments in Supplier and Customer Industries

	Investment in Supplier Industries	Investment in Customer Industries
Dependent Variable →	Sup_Inv	Cus_Inv
Main_Inv	0.033*** (0.01)	0.027*** (0.01)
Sup_Rel*Main_Inv / Cus_Rel*Main_Inv	0.206** (0.09)	0.004 (0.02)
Sup_Rel / Cus_Rel	-3.644*** (0.97)	0.114 (0.294)
# of Observations	50217	49076

**Table 12****Robustness of Performance Measures on Main and Related Investment**

The sample consists of all mutual funds in the Thomson/CDA holdings database and CRSP mutual fund database for which data are available for the period from 1980 to 2006 and does not include index funds, funds that invest in less than 10 stocks or invest less than 50% of net assets in stocks, and funds with total net assets less than \$1 million. *Main Industry* is the industry in which a fund has the highest % level of investment. *Related Industries* are the five main supplier industries and five main customer industries according to the I/O Tables. The variable *Main\_Inv* equals investment in the *Main industry* divided by *Total Assets*, *Rel\_Inv* equals investment in the *Related Industries* divided by *Total Assets*, and *Sup\_Inv* (*Cus\_Inv*) equals investment in the five main suppliers (customers) divided by *Total Assets*. The dependent variables are the holding-based performance measures of stock selection (*CS*) and timing (*CT*) using the Daniel, Grinblat, Titman, and Wermers (1997). Heteroskedasticity robust standard errors are in parentheses. The symbols <sup>\*\*\*</sup>, <sup>\*\*</sup>, and <sup>\*</sup> denote significance at the 1%, 5%, and 10%, respectively.

## Panel A. Subsample 1980--1994

Dependent Variable →	CS	CT	<u>Uncond. Alpha</u>	<u>Cond. alpha</u>
Main_Inv	0.445 (0.54)	-0.351 (0.24)	0.0004 (0.001)	0.004 (0.007)
Rel_Inv	0.264 (0.58)	0.027 (0.23)	0.020 <sup>***</sup> (0.007)	0.015 <sup>*</sup> (0.009)

## Panel B. Subsample 1995--2006

Dependent Variable →	CS	CT	<u>Uncond. Alpha</u>	<u>Cond. alpha</u>
Main_Inv	0.398 (0.58)	-0.811 <sup>***</sup> (0.25)	-0.007 (0.006)	-0.001 (0.007)
Rel_Inv	5.25 <sup>***</sup> (0.57)	1.259 <sup>***</sup> (0.25)	0.064 <sup>***</sup> (0.01)	0.051 <sup>***</sup> (0.01)

## Panel C. Performance Measures on Supplier and Customer Investments

Dependent Variable →	CS	CT	<u>Uncond. Alpha</u>	<u>Cond. alpha</u>
Main_Inv	0.810 <sup>**</sup> (0.42)	-0.551 <sup>***</sup> (0.18)	-0.001 (0.005)	0.002 (0.005)
Sup_Inv	3.209 <sup>***</sup> (0.47)	0.961 <sup>***</sup> (0.20)	0.030 <sup>***</sup> (0.006)	0.020 <sup>***</sup> (0.006)
Cus_Inv	2.057 <sup>***</sup> (0.56)	0.016 (0.25)	0.027 <sup>***</sup> (0.007)	0.022 <sup>***</sup> (0.008)