Cross-Industry Momentum*

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Abstract

This paper documents a strong cross-momentum effect among industries that are related to each other along the supply chain. Specifically, trading strategies that buy and sell industries based on respectively high and low past returns in related upstream or downstream industries yield significant profits. Cross-industry momentum is distinct from previously documented stock- and industry-level momentum, and other known return factors.

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1 Introduction

In this paper, we document strong positive cross-autocorrelation among industries that are related to each other along the supply chain. Specifically, using data on inter-industry flow of goods and services from the Input-Output Benchmark Survey of the Bureau of Economic Analysis and the set of inter-industry relationships implied in these data, we show that industry returns lag related customer and supplier industry returns. In addition, we show that this relation for aggregate industry portfolio-level data also holds for stock-level data. Indeed, based on major customer information from Compustat, we show that stock-specific customer returns have similar predictive properties and that stock returns lag stock-specific customer returns. Our analyses further show that these cross-momentum effects are distinct from previously documented stock- (Jegadeesh and Titman, 1993, 2001) and industry-level (Moskowitz and Grinblatt, 1999) momentum effects.[1]

Trading strategies based on cross-industry effects produce economically significant profits. For example, a self-financing trading strategy that consists of buying and selling industries based on respectively high and low returns in related upstream industries over the previous month yields an annual premium as high as 7 percent and a Sharpe ratio of about 0.85. A similar trading strategy based on previous-month related downstream industry returns yields an annual premium as high as 6 percent and a Sharpe ratio of about 0.70.

Returns from cross-industry momentum strategies hold up well in diagnostic tests and exhibit little exposure to well known return factors such as Fama-French SMB and HML and Carhart MOM. Strategies with various formation and holding periods reveal strong cross-industry momentum for up to three months and especially in the one-month period after portfolio formation, in contrast to stock-level reversal over the same horizon. In addition, cross-industry momentum strategies are

[1] We use the term cross-industry momentum throughout the paper to distinguish our findings from prior works on stock- and industry-level momentum.

consistently profitable in subsamples as well as through NBER business cycles with profitability coming from both the short and long positions, unlike individual stock momentum strategies whose profitability comes largely from selling past losers.

Our analyses also show that cross-industry momentum is robust to the exclusion of stocks with market capitalizations less than the 20th percentile of NYSE stocks, and so the cross-industry effects that we document in this paper are distinct from findings of delayed price response among micro-cap stocks. (Also see Lo and MacKinlay (1990), Brennan, Jegadeesh and Swaminathan (1993), Mech (1993), Hou (2002), Hou and Moskowitz (2002).) In contrast to delayed price response, which appears to be a predominantly intra-industry effect with large firms leading small firms in their own industries (Hou, 2002), cross-industry momentum is an inter-industry effect.

To our knowledge, the present paper is the first to show return persistence *across* industries and stocks that are economically related to each other along the supply chain. Perhaps most related to the present paper is work by Moskowitz and Grinblatt (1999) who document autocorrelation in industry returns and conjecture that industry momentum could be due to cross-autocorrelation among stocks within the same industry. Hong, Torous and Valkanov (2003) show that a number of industries lead the stock market by up to two months, which is consistent with cross-industry momentum at the aggregate level. Hong, Lim and Stein (2000) focus on stock-level momentum and find that momentum strategies work better among small stocks with low analyst coverage. The findings of Hong, Lim and Stein (2000) are broadly consistent with models of informationally segmented markets and the hypothesis that information intermediation affects the speed with which firm-specific information diffuses across the investing public. Our findings lend further support to this gradual diffusion of information hypothesis.

The paper proceeds as follows. Section 2 describes the data sources and return series used throughout the paper. In Section 3, we present panel and Fama-MacBeth regressions that show

cross-industry persistence in returns. We examine trading strategies based on cross-industry effects in Section 4. We investigate several robustness issues in Section 5 and then conclude in Section 6.

2 Data

Monthly return files (January 1963 - December 2002) from the Center for Research in Security Prices (CRSP) and the Input-Output Benchmark Survey of the Bureau of Economic Analysis (the BEA Survey, hereafter) constitute our main data sources. The BEA Survey assigns overall economic activity in the U.S. into one of 85 industry accounts and reports the extent of inter-industry flow of goods and services among them.

Our return sample is constructed from all stocks traded on NYSE, Amex and Nasdaq. We exclude closed-end funds, real estate investment trusts, American Depositary Receipts, foreign companies, primes and scores. Using the industry account-SIC code dictionary provided as part of the BEA Survey, we assign stocks to their respective industries based on their reported SIC codes in Compustat with the condition that there be a market capitalization at the end of June in a given year for a stock to be included in the analysis for the subsequent 12 months.[2] We then calculate value-weighted monthly industry returns in excess of the one-month Treasury bill rate observed at the beginning of the month. Finally, we construct upstream (representative supplier) and downstream (representative customer) portfolio returns for each industry using the flow of goods and services data from the BEA Survey as portfolio weights.

[2] In a small number of instances where a SIC industry is associated with more than one industry account in the BEA Survey, we keep the first entry in the dictionary and drop the remaining entries to prevent a hard-wired cross-industry momentum result based on stock- and industry-level momentum. We impose the requirement that there be a market capitalization at the end of June in a given year for a stock to be included in the analysis for the subsequent 12 months primarily to stabilize the composition of the industry portfolios.

Formally, our return series are calculated as follows:

$$R_{i,t} = \sum_{j_1 \in i} \frac{M_{j_1,t-1}}{\sum_{j_2 \in i} M_{j_2,t-1}} R_{j_1,t} \quad (1)$$

$$R^{us}_{i,t} = \sum_{k_1 \neq i} \frac{C_{k_1,i}}{\sum_{k_2 \neq i} C_{k_2,i}} R_{k_1,t} \quad (2)$$

$$R^{ds}_{i,t} = \sum_{k_1 \neq i} \frac{C_{i,k_1}}{\sum_{k_2 \neq i} C_{i,k_2}} R_{k_1,t} \quad (3)$$

where $M_{j,t-1}$ is the market capitalization of firm j at the end of month $t-1$, $R_{j,t}$ is the stock return of firm j in month t, $R_{i,t}$ is the value-weighted return in month t of firms in industry i, $R^{us}_{i,t}$ $\left(R^{ds}_{i,t}\right)$ is the weighted return in month t of industry i's upstream (downstream) industries weighted by the flow of goods and services into (out of) industry i, and $C_{k,i}$ is the flow of goods and services from industry k to industry i.

Table I presents annualized summary statistics for the 65 industries used in this paper out of the original 85 industry accounts provided in the BEA Survey. We drop the last eight catch-all accounts of the Survey (78 through 85, mainly related to government, import and inventory adjustments) because these accounts do not appear to correspond to any clear economic activity or industry. We also drop the wholesale/retail industry account to avoid potential measurement error due to the fact that the BEA Survey lumps all wholesale and retail activity in the economy into one industry account. While most industries sell their output through a wholesale or retail establishment, this coarseness makes the account fairly noisy as a downstream customer for any one industry. Finally, we lose 11 more industry accounts due to a lack of sufficient number of firms to consistently form meaningful industry portfolios. The average total market value of dropped firms is about 9 percent of all CRSP stocks across the sample period – of which the wholesale/retail industry alone constitutes 6 percent.

The cross-sectional mean (0.0623) and standard deviation (0.0228) of average industry returns are comparable to those of widely used 48 Fama-French industries (Fama and French, 1997). Over

the same sample period, the corresponding statistics for the 48 Fama-French industries are 0.0665 and 0.0198, respectively.[3]

We should mention that the volume of inter-industry trade used in our construction of upstream and downstream returns comes from the 1987 BEA Survey. As much as we would like to avoid using data that only became available after the fact for some of the years in our predictive regressions and trading strategies, we are constrained by the fact that the BEA first published its survey in 1982. Since then, there have been just three more surveys (1987, 1992 and 1997) as these surveys are published once in every five years using comprehensive Census data.

As a robustness check, we have run our programs using the 1982 and 1992 surveys.[4] The results are essentially unchanged. We obtain almost identical results because the correlation among the surveys is extremely high. Specifically, the correlation of upstream portfolio weights, $\frac{C_{k,i}}{\sum_{k \neq i} C_{k,i}}$, is 0.9647 between 1987 and 1982, 0.9628 between 1987 and 1992, and 0.9456 between 1982 and 1992. The corresponding statistics for downstream portfolio weights, $\frac{C_{i,k}}{\sum_{k \neq i} C_{i,k}}$, are 0.9474, 0.9466, and 0.9382. It is clear from these high correlations that the structure of the supply chain has not changed much over time, and that there is a high degree of stability in the upstream and downstream relationships.

3 Predicting Industry Returns

Our main empirical approach in this section entails estimation of panel and Fama-MacBeth (Fama and MacBeth, 1973) regressions to predict industry returns using lagged returns in related upstream

[3] Based on monthly return series for the 48 Fama-French industries from Ken French's web site at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/.

[4] We could not use the 1997 survey because the BEA switched the way it classified industries in 1997 from SIC to NAICS, which makes the link to CRSP problematic.

and downstream industries. We analyze self-financing trading strategies based on lagged related industry returns in the next section.

3.1 Panel Regressions

To explore cross-industry persistence in industry returns, we estimate variants of the following panel regression:

$$R_{i,t} = a_t + b_1 * R^{us}_{i,t} + b_2 * R^{ds}_{i,t} + c_1 * R_{i,t-1} + c_2 * R^{us}_{i,t-1} + c_3 * R^{ds}_{i,t-1} \tag{4}$$

where $R_{i,t}$, $R^{us}_{i,t}$ and $R^{ds}_{i,t}$ are contemporaneous own, upstream and downstream returns of industry i in month t, respectively. We include year-month fixed effects a_t to absorb systematic market return in a given month and compute standard errors that are robust to clustering (statistical dependence of error terms) at the monthly level.[5] We are interested in the predictive power of $R_{i,t-1}$, $R^{us}_{i,t-1}$ and $R^{ds}_{i,t-1}$ which are lagged own, upstream and downstream returns of industry i in month $t-1$, respectively.

Table II reports our results in four columns. The first column shows that $R_{i,t}$ is strongly related to contemporaneous returns in upstream and downstream industries as evidenced by economically and statistically significant coefficients on $R^{us}_{i,t}$ (0.3353) and $R^{ds}_{i,t}$ (0.2084). The magnitude of these coefficients show that the BEA Survey is providing us with economically meaningful supplier and customer industry relationships. Note that these relationships contemporaneously explain industry-level portfolio returns over and above the systematic market component captured with the year-month fixed effect a_t.

We next investigate own industry momentum in column 2. Consistent with the findings of Moskowitz and Grinblatt (1999), we find that high past industry returns predict high future industry

[5] For cluster-correlated robust standard errors, see Froot (1989), Rogers (1993) and Wooldridge (2002, section 13.8.2).

returns as evidenced by a statistically significant positive coefficient on $R_{i,t-1}$ (0.0363). While the industry definitions used in this paper are somewhat different, it is reassuring to see that the BEA Survey industry accounts exhibit similar return patterns that have been found to be significant in previous work. Including contemporaneous upstream and downstream returns in column 3 reduces the coefficient on $R_{i,t-1}$ (0.0304) slightly, but does not alter its statistical significance. We find this to be true throughout our analysis – own industry momentum and cross-industry momentum appear to be statistically distinct phenomena.

Having established these basic results, we explore the predictive power of returns in upstream and downstream industries in column 4. We find strong cross-industry momentum from both upstream and downstream industries as evidenced by statistically significant positive coefficients on $R^{us}_{i,t-1}$ (0.0575) and $R^{ds}_{i,t-1}$ (0.0380). Compared to own industry momentum (0.0259), cross-industry momentum from upstream industries appears to be more than twice as large, and almost 50 percent larger from downstream industries. Combined together, cross-industry momentum from upstream and downstream industries presents a magnitude of predictability that is more than three times that of own industry momentum.

In unreported regressions, we explore whether different sources of return predictability interact with each other and find statistically insignificant coefficients on interaction terms $R^{us}_{i,t-1} * R^{ds}_{i,t-1}$, $R^{us}_{i,t-1} * R_{i,t-1}$ and $R^{ds}_{i,t-1} * R_{i,t-1}$. We also check whether returns of randomly formed portfolios of industries have any predictive power similar to that of upstream and downstream portfolio returns. This exercise yields no significant predictive results as well, which among other things shows that our findings are not driven by macro shocks such as oil prices or interest rates that smear across *all* stocks potentially with some lag.

3.2 Fama-MacBeth Regressions

To further explore the robustness of our results about cross-industry momentum from upstream and downstream industries, we estimate Fama-MacBeth regressions in this subsection, first at the industry level and then at the stock level. Monthly regressions at the stock level enable us to further control for stock-level momentum (Jegadeesh and Titman, 1993) in addition to industry-level momentum (Moskowitz and Grinblatt, 1999).

Industry-level regressions take the following form for each month:

$$R_{i,t} = a + b_1 * R_{i,t-1} + b_2 * R^{us}_{i,t-1} + b_3 * R^{ds}_{i,t-1} \tag{5}$$

We exclude contemporaneous upstream and downstream returns so that we can ultimately interpret estimated coefficients as premiums that can be replicated with a tradeable portfolio strategy. Controlling for estimated return betas (market, HML and SMB) as well as industry characteristics (book-to-market, size and financial leverage) makes no difference to our results.

Table III Panel A reports means and t-statistics of estimated coefficients from industry-level monthly regressions (assuming independence of estimated coefficients across monthly regressions). Columns 1, 2 and 3 confirm the standalone significance of own industry momentum and cross-industry momentum from upstream and downstream industries, respectively. The mean coefficients on $R_{i,t-1}$ (0.0474), $R^{us}_{i,t-1}$ (0.1246) and $R^{ds}_{i,t-1}$ (0.0727) are large and statistically significant. We include the three predictive variables together in column 4 and find that cross-industry momentum remains economically significant as evidenced by statistically significant positive coefficients on $R^{us}_{i,t-1}$ (0.1036) and $R^{ds}_{i,t-1}$ (0.0570). Once again, the combined magnitude of cross-industry momentum from both upstream and downstream industries appears to surpass that of own industry momentum – the combined total is a remarkable annual premium of 16.1%.

Table III Panel B reports means and t-stats of estimated coefficients from stock-level monthly

regressions of the form:

$$R_{j(i),t} = a + b_1 * R_{i,t-1} + b_2 * R^{us}_{i,t-1} + b_3 * R^{ds}_{i,t-1} + b_4 * R_{j,t-k_1:t-k_2} \tag{6}$$

where $R_{j(i),t}$ is the return for firm j (in industry i) in month t and $R_{j,t-k_1:t-k_2}$ is the cumulative return for firm j from month $t-k_2$ to $t-k_1$.

The first column in Panel B reports exactly the same specification as the one in Panel A column 4 except that observations in the monthly regressions are now at the stock level instead of industry. The mean coefficient on $R_{i,t-1}$ (0.1299) is significantly larger at the stock level, indicating that there is a size dimension to own industry momentum and that it is significantly stronger among smaller stocks. This is also consistent with own industry momentum being predominantly about large firms leading same-industry small firms (Hou, 2002). The mean coefficient on $R^{us}_{i,t-1}$ (0.0879) and $R^{ds}_{i,t-1}$ (0.0513) are slightly smaller at the stock level.

Controlling for stock-level momentum, the annual premium on cross-industry momentum from upstream and downstream industries continues to remain fairly high: 13.7% in column 2 (where we control for stock-level momentum for prior month $t-9$ through $t-4$) and 12.9% in column 3 (where we control for stock-level momentum for prior month $t-12$ through $t-2$). The annual premium on $R_{j,t-2:t-12}$ is 8.2% (mean coefficient of about 0.75% multiplied by eleven to account for the scale difference between $R_{j(i),t}$ and $R_{j,t-2:t-12}$). Further controlling for stock-level short-term reversal effects at the one-month horizon in column 4, the mean coefficient on both $R^{us}_{i,t-1}$ (0.0861) and $R^{ds}_{i,t-1}$ (0.0541) continue to remain significant.

An interesting question at this point is to what extent lagged upstream and downstream returns contain information about industry-wide conditions. Potentially, there might not be any cross-industry predictability left once lagged stock-specific supplier and customer returns are included in the regressions. Although upstream and downstream portfolios are fairly diversified, the possibility of stock-specific signals being left over cannot be ruled out.

Fortunately, we can address this question in part for cross-industry momentum from downstream industries by using customer list information from Compustat.[6] However, we should note that Compustat's coverage of the customer data is fairly spotty and becomes reliable only after 1998.[7,8] As a result, our conclusions will have to be measured and limited for a relatively short period from 1999 to 2002.

The first column in Panel C shows that stock-specific customer returns in the previous three month period predict stock returns over the next month. The annual premium on $R_{customer-j,t-1:t-3}$ is 10.89% (mean coefficient of 3.63% multiplied by three to account for the scale difference).[9] During this period, own, upstream and downstream industry momentum are also strong as evidenced by large mean coefficients on $R_{i,t-1}$ (0.1270), $R^{us}_{i,t-1}$ (0.2360) and $R^{ds}_{i,t-1}$ (0.2770%) in column 2. In comparison, stock-level momentum is absent during this period as evidenced by a statistically

[6] Compustat gathers the name of major customers from company segment reports provided per FASB Statement 14. Specifically, FASB Statement 14 requires that: "If 10 percent or more of the revenue of a company is derived from sales to any single customer, that fact and the amount of revenue from each customer must also be disclosed."

[7] The number of company-customer pairs in any given year in the data set hovers around 1,000 from 1977 to 1998, and then jumps to 14,000 in 1999 as Compustat starts reliable, unbiased coverage of the data.

[8] We use a fairly sophisticated name-matching algorithm to link customer names to potential gvkeys in Compustat and then to permnos in the merged CRSP-Compustat database. To increase the accuracy of the links (i.e. to minimize measurement error), we also go through the potential matches manually. In many cases, we are able to find more than one customer per stock in a given year, in which case we construct a portfolio return using the customer returns and the reported amount of sales to each customer divided by total sales to all of the customers as portfolio weights.

[9] In unreported regressions, we explore the predictive power of stock-specific customer returns for lags of up to 12 months. Apart from the significant predictive power of the first three months reported here, the sixth month also appear to have some predictive power. In addition, we explore the use of the customer list in reverse, in effect making it a "supplier" list. This exercise yields no significant predictive results. One reason for this might be that if company A is a major customer of company B, then company A is likely to be a larger enterprize than company B and, as a result, company B is unlikely to be a major supplier of company A.

insignificant mean coefficient on $R_{j,t-2:t-12}$ (0.0020) in column 3. Stock-level short-term reversal is present as evidenced by a statistically significant mean coefficient on $R_{j,t-1}$ (-0.0454). Finally, column 4 shows that downstream industry momentum remains significant even after controlling for lagged stock-specific customer return as evidenced by a statistically significant mean coefficient on $R^{ds}_{i,t-1}$ (0.2211). This limited evidence suggests that upstream and downstream portfolios are fairly diversified and hence lagged upstream and downstream returns contain information about industry-wide conditions as opposed to idiosyncratic stock-specific information.

Overall, our findings in this section would seem to indicate that cross-industry momentum is statistically and economically significant, and that cross-industry momentum is distinct from previously documented stock and industry level momentum effects. A natural follow-up question is whether trading strategies based on cross-industry momentum can produce significant profits, which is what we examine next.

4 Trading Strategies

This section examines trading strategies based on cross-industry momentum. Our goal is to assess the profitability of self-financing trading strategies and identify their important sources.

The way we construct our trading strategies is fairly standard. At the beginning of each month, we sort industries into five bins based on upstream or downstream returns in the previous month. Industries with previous month related industry returns in the bottom quintile get allocated to the first bin, industries with previous month related industry returns in the second quintile get allocated to the second bin, and so on. After sorting industries in this fashion, we form equal-weighted and value-weighted portfolios for each of the five bins, and calculate returns on these portfolios for the ensuing one-month period. We use the market capitalization of industries at the end of the previous month in forming value-weighted portfolios. Our self-financing trading strategies consist of buying

the high bin portfolio (industries with previous month related industry returns in top quintile) and selling the low bin portfolio (industries with previous month related industry returns in the bottom quintile).

Table IV reports mean and standard deviation of annualized one-month excess returns for the five portfolios described above. Looking at Panel A in which industries are sorted according to previous month upstream returns, mean excess return over the next month is 9.7% for the equal-weighted high portfolio and 2.9% for the equal-weighted low portfolio. A self-financing trading strategy that exploits the return difference between the two portfolios yields 6.8% with a Sharpe ratio of 0.85. With value-weighting, mean excess return for the high portfolio falls slightly to 8.1%. Because mean excess return for the low portfolio also falls slightly to 1.6%, the return difference between the two portfolios remains high at 6.5% with a Sharpe ratio of 0.57.

Sorting industries on the basis of downstream returns over the previous month proves profitable as well. The results for this sort are reported in Panel B. There is again a visible positive trend in mean excess returns across the five portfolios. A self-financing trading strategy that exploits the return difference between the equal-weighted high portfolio (8.6%) and the equal-weighted low portfolio (3.0%) yields 5.6% with a Sharpe ratio of 0.70. With value-weighting, the yield comes out slightly higher at 6.0% with a Sharpe ratio of 0.44.

We also report results from similarly constructed stock-level trading strategies in Panel C using lagged stock-specific customer return data from 1999 to 2002. Sorting stocks on the basis of stock-specific customer returns over the previous three month period, an equal-weighted self-financing strategy yields 37.4% with a Sharpe ratio of 1.10. With value-weighting, the yield comes out slight higher at 42.1% with a lower Sharpe ratio of 0.97.

Overall, it would appear that trading strategies based on lagged supplier and customer industry returns can generate significant profits. In the next two subsections, we conduct several diagnostic

tests and examine trading strategies with longer formation and holding periods.

4.1 Diagnostic Tests

A potential concern that one might have is that our results are mainly driven by a small number of industries entering our trading strategies in some excessive way. We find that while there is some heterogeneity in inclusion probabilities, the amount is not excessive so as to drive our results. Table V reports inclusion probabilities for the two trading strategies based on previous month upstream and downstream returns examined above. To put the observed probabilities into perspective, if industries were identical in their inclusion probabilities, they would enter our trading strategies roughly 1.5 percent of the time (one divided by 65). We find that the maximum inclusion probability of an industry rarely exceeds three percent in any of the portfolio (short versus long) and strategy (upstream versus downstream) combinations and that, when it does, the industry in question also appears in the opposite portfolio of the strategy with a similarly high probability. This last fact is important because it shows that the profitability of our trading strategies is not driven by simply going long and short in industries with historically high and low returns, respectively.

Another concern that one might have is that the profits from our trading strategies contain systematic risk. To check whether the returns that we document represent compensation for taking on systematic risk, we regress monthly returns from our trading strategies on widely recognized return factors such as the Fama-French HML and SMB, and Carhart MOM, and find that cross-industry momentum returns are by and large orthogonal to them. The first two columns of Table VI report estimated return betas for the monthly returns of the two trading strategies examined above. Except for some exposure to the momentum factor (0.0887 for the upstream strategy and 0.0600 for the downstream strategy, compared to 0.2327 in unreported regressions for an analogous trading strategy based on own-industry momentum), the monthly returns do not exhibit much systematic

exposure. The intercept is 0.48% for the upstream strategy and 0.41% for the downstream strategy. In line with our previous results, these intercepts translate into annualized Jensen's alphas of about 6% and 5%, respectively. We also try to alleviate a potential concern that our trading strategies might be exposed to return factors differently along the business cycle. In the last two columns, we include interaction terms with a business-cycle indicator variable using NBER recession dates. The estimated intercept term for the upstream strategy falls to 0.40% because the strategy appears to be more profitable during NBER recessions as evidenced by a statistically significant coefficient of 0.56% on the NBER recession indicator variable. The estimated intercept term for the downstream strategy stays relatively unchanged at 0.40% with slightly higher exposure to the momentum factor (0.1785) during NBER recessions.

Finally, we check whether cross-industry momentum is driven by micro stocks and related market microstructure influences. Specifically, we recalculate industry and related industry returns using only stocks with market capitalizations above the 20^{th} percentile NYSE cutoff and rerun our analyses. With micro stocks excluded, we continue to find significant results, although they are slightly weaker at times. Table VII reports mean and standard deviation of annualized excess one-month returns on the five portfolios formed by sorting industries based on previous month upstream and downstream returns. Mean returns exhibit a positive trend as in Table IV. Self-financing trading strategies that exploit the return difference between the high bin portfolio (comprised of industries with previous month related industry returns in the top quintile) and the low bin portfolio (comprised of industries with previous month related industry returns in the bottom quintile) yield about 5% which is slightly less than the yield of about 6% in Table IV. These results lead us to conclude that cross-industry momentum is in some part but not completely driven by micro stocks and related market microstructure influences.

4.2 Longer Formation and Holding Periods

We examine self-financing trading strategies with longer formation and holding periods in this subsection. The strategies that we consider select industries based on related industry returns over the past $J \in \{1, 3, 6, 12\}$ months and hold them over the next $K \in \{1, 3, 6, 12\}$ months. As a result, in any given month, our strategies hold a series of K portfolios that are selected at the beginning of the month as well as $K - 1$ months ago on the basis of previous J-month related industry returns at the time of portfolio formation. We consider both equal-weighted and value-weighted strategies. Value-weighted strategies use the market capitalization of industries.

Table VIII reports annualized mean monthly returns for the 16 J/K strategies that we consider. Comparing the yield on the equal-weighted 1/3 upstream strategy (4.0%) with the yield on the equal-weighted 1/1 upstream strategy (6.8%) in Panel A, it appears that upstream momentum continues well after the first month for the average industry, although not quite at its strong initial pace. [To see this, note that the yield on the 1/3 strategy is the average of first, second and third month returns. If there were no upstream momentum after the first month, the yield on the 1/3 strategy would have been about 2.3% (6.8% divided by three).] The yield on the 1/12 strategy (1.6%) indicates that upstream momentum continues only weakly for the rest of the year. [The implied yield for the rest of the year after the third month comes out to about 0.8%.] Hence, we conclude that a significant portion of upstream momentum plays out over a short horizon. This conclusion is also supported by the weaker performance of upstream strategies with formations periods longer than one month. For all but one of the four holding periods considered, upstream strategies with a one-month formation period produce the highest returns.

The results for downstream strategies in Panel B show that downstream momentum develops more gradually than upstream momentum. Comparing the yield on the equal-weighted 1/3 strategy (1.8%) with the yield on the equal-weighted 1/1 strategy (5.6%), there does not appear to be any

meaningful downstream momentum in the two-month period after the first month. The yield on the 1/12 strategy is 1.2%, however, which indicates that there is renewed downstream momentum for the rest of the year, at a slightly stronger pace than upstream momentum over the same horizon. In another contrast to upstream momentum, for all but one of the four holding periods, downstream strategies with formation periods longer than one month produce the highest returns.

An additional interesting result in Table VIII is the difference between equal-weighted and value-weighted strategies. Equal-weighted upstream strategies consistently outperform their value-weighted counterparts in Panel A whereas the reverse is true for downstream strategies in Panel B. In a relative sense, it would appear that downstream momentum is stronger among large industries and upstream momentum is stronger among small industries.

5 Robustness

In this section, we aim to alleviate a concern that our single-sort trading strategies based on related industry returns might be benefiting from own-industry momentum. The concern comes from the fact that contemporaneous upstream, downstream and own industry returns are highly correlated. [See Table 2, column 1]. We use the multivariate panel regression approach of Section 3 to address this concern.

In Table IX, we estimate variants of the following panel regression:

$$\begin{aligned} R_{i,t} &= a_t + b_{Long} * 1\left[R_{i,t-1} \geq p_{80\%}\left(R_{t-1}\right)\right] + b_{Short} * 1\left[R_{i,t-1} \leq p_{20\%}\left(R_{t-1}\right)\right] \\ &+ c_{Long} * 1\left[R^{us}_{i,t-1} \geq p_{80\%}\left(R^{us}_{t-1}\right)\right] + c_{Short} * 1\left[R^{us}_{i,t-1} \leq p_{20\%}\left(R^{us}_{t-1}\right)\right] \\ &+ d_{Long} * 1\left[R^{ds}_{i,t-1} \geq p_{80\%}\left(R^{ds}_{t-1}\right)\right] + d_{Short} * 1\left[R^{ds}_{i,t-1} \leq p_{20\%}\left(R^{ds}_{t-1}\right)\right] \end{aligned} \tag{7}$$

where the indicator variables proxy for trading strategies by taking on a value of one for industry-month observations that fall into either the high bin (the top quintile) or the low bin (the bottom

quintile) based on previous month own, upstream and downstream industry returns.[10]

Columns 1 through 3 include each trading strategy individually and thus represent the profitability of single-sort strategies. Compared to the profitability of own industry-momentum of about 6.5% annually (19 basis points on the long portfolio and 35 basis points on the short portfolio multiplied by 12), the upstream and downstream strategies yield 6.8% (29 basis points on the long portfolio and 28 basis points on the short portfolio multiplied by 12) and 5.6% (17 basis points on the long portfolio and 30 basis points on the short portfolio multiplied by 12), respectively. Note that these two upstream and downstream yields are numerically equivalent to the equal-weighted trading results in Table IV because the univariate regression coefficients amount to equal-weighted sample average returns.

In column 4, we include all three trading strategies simultaneously and find essentially the same results. While the yields are slightly lower (5.7% for own-industry momentum, 6.0% for upstream momentum and 4.7% for downstream momentum), no single strategy drives out the other two.

We end this section by looking into a couple of additional robustness issues. First, we check whether cross-industry momentum revolves around the January effect. In column 5, we exclude the month of January from the sample. Running the same specification as above, we find no significant change in yields.

In columns 6 and 7, we split the sample into two halves, 1963-1982 and 1983-2002, and find that while the profitability of own, upstream and downstream strategies have remained robust, their composition has changed somewhat over time. Most notably, it appears that the profitability of the upstream strategy has switched from the short portfolio in the first half of the sample to the long portfolio in the second half, indicating a potentially easier source of profits. The same is also true for the downstream strategy whose profitability appears to come increasingly from the

[10] We thank Mark Grinblatt for suggesting this specification as a robustness check.

long portfolio of the strategy in the second half of the sample. The profitability of own-industry momentum is weaker in the second half than in the first half, however, with all of the profits in the second half coming from the short portfolio.

Finally, we plot cumulative excess returns from trading strategies based on previous month upstream (solid line) and downstream (dashed line) returns in Figure 1. Both strategies appear to be consistently profitable over the sample period regardless of the state of the economy (shaded areas are NBER recessions).

6 Conclusion

This paper documents a strong cross-momentum effect among industries related to each other along the supply chain. Using data about the flow of goods and services across industries from the Input-Output Benchmark Survey of the Bureau of Economic Analysis and the set of inter-industry relationships implied in these data, we show that industry returns lag returns in related industries. Trading strategies that consist of simultaneously buying and selling industries with respectively high and low returns in upstream or downstream industries over the previous month yield significant profits.

A relatively recent body of research motivated by findings of momentum at the stock- and industry-level offers a number of explanations for cross-industry momentum. One interesting mechanism at work might be underreaction on the part of investors to important developments in upstream and downstream industries regarding demand as the conservatism bias of Barberis, Shleifer and Vishny (1998) and the overconfidence bias of Daniel, Hirshleifer and Subrahmanyam (1998) would suggest. Cross-industry momentum might be evidence that investors are susceptible to behavioral biases when confronted with distant information in supplier and customer industries.

Alternatively, cross-industry momentum might be a sign of gradual diffusion of information

across specialized and segmented markets as suggested by Hong and Stein (1999), Holden and Subrahmanyam (2002), and Hong, Torous, and Valkanov (2003). Yet another rational explanation could be based on positively correlated industry growth shocks, much in the spirit of Berk, Green and Naik (1999) and Johnson (2002). Return persistence in these models operate at long horizons, however, and cross-momentum appears to be at work mostly at short horizons.

More work lies ahead before we know whether cross-industry momentum is a widespread return pattern in other stock markets. Fortunately, the Input-Output Benchmark Survey of the Bureau of Economic Analysis is a common type of census analysis carried out in most OECD countries. In addition to exploring cross-industry momentum internationally, a cross-country study can shed some light on the relation between financial development and the speed with which related industry information is priced. We leave these ideas and extensions to future research.

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Figure 1: Performance of upstream and downstream strategies (1963-2002)

This figure plots the cumulative excess returns from trading strategies based on previous month upstream and downstream returns over the sample period, January 1963 to December 2002. Shaded areas are NBER recessions.

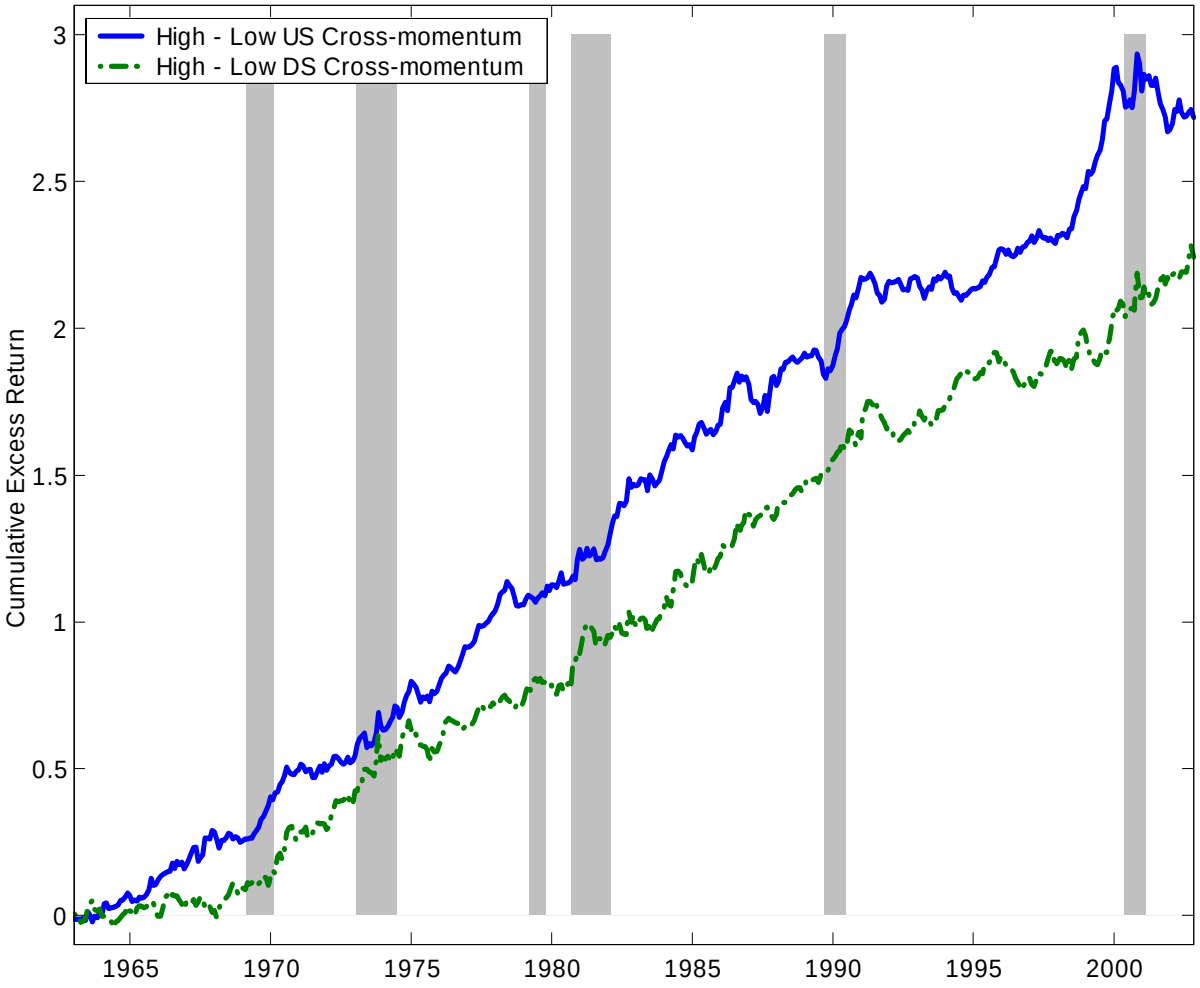

Table I

Summary Statistics

This table presents summary statistics for 77 industries as defined in the Input-Output Benchmark Survey of the Bureau of Economic Analysis. Firms are assigned to industries using CRSP SIC codes and the industry account-SIC code dictionary provided in the Survey. Industry returns are value-weighted and computed monthly (January 1963 - December 2002) in excess of the one-month Treasury bill rate observed at the beginning of the month. Upstream return for an industry is defined as the return on a portfolio of upstream industries using the inter-industry flow of goods and services reported in the Use Table of the Survey as portfolio weights. Downstream return is defined similarly as the return on a portfolio of downstream industries using the inter-industry flow of goods and services as portfolio weights. Summary statistics are annualized.

		Industry return		Upstream return		Downstream return	
Industry	Industry name	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
1	Livestock and livestock prod.	--	--	--	--	--	--
2	Other agricultural prod.	--	--	--	--	--	--
3	Forestry and fishery prod.	--	--	--	--	--	--
4	Agricultural, forestry, and fishery	--	--	--	--	--	--
5	Iron and ferroalloy ores mining	--	--	--	--	--	--
6	Nonferrous ores mining	0.0599	0.3252	0.0562	0.1698	0.0305	0.2421
7	Coal mining	0.1054	0.3052	0.0550	0.1769	0.0316	0.1381
8	Crude petroleum and natural gas	0.0328	0.2391	0.0308	0.2030	0.0625	0.1584
9	Stone and clay mining and quarrying	--	--	--	--	--	--
10	Chemical and fertilizer mineral mining	--	--	--	--	--	--
11	New construction	--	--	--	--	--	--
12	Maintenance and repair construction	0.1007	0.3736	0.0536	0.1794	0.0395	0.1849
13	Ordnance and accessories	0.0743	0.2170	0.0640	0.2023	0.0714	0.2206
14	Food and kindred prod.	0.0786	0.1623	0.0642	0.1756	0.0715	0.2166
15	Tobacco prod.	--	--	--	--	--	--
16	Broad, narrow fabrics; yarn, thread mills	0.0475	0.2368	0.0521	0.1738	0.0716	0.2335
17	Misc. textile goods and floor coverings	0.0871	0.3392	0.0491	0.1839	0.0648	0.2085
18	Apparel	0.0701	0.2442	0.0533	0.2035	0.0812	0.2296
19	Misc. fabricated textile prod.	0.0703	0.4293	0.0581	0.2031	0.0652	0.2034
20	Lumber, wood prod.; exc. containers	0.0923	0.2877	0.0601	0.1758	0.0618	0.1793
21	Wood containers	--	--	--	--	--	--
22	Household furniture	0.0934	0.2382	0.0689	0.1983	0.0616	0.2583
23	Other furniture and fixtures	0.0802	0.2246	0.0578	0.1976	0.0484	0.2185
24	Paper, allied prod.; exc. containers	0.0478	0.1838	0.0624	0.1751	0.0690	0.1869
25	Paperboard containers and boxes	0.0664	0.2531	0.0497	0.1750	0.0672	0.1629
26	Printing and publishing	0.0707	0.1989	0.0564	0.1765	0.0766	0.2156
27	Chemicals, selected chemical prod.	0.0463	0.1905	0.0570	0.1602	0.0595	0.1759
28	Plastics and synthetic materials	0.0432	0.2081	0.0521	0.1754	0.0588	0.1925
29	Drugs, cleaning and toilet prep.	0.0793	0.1724	0.0630	0.1791	0.0816	0.2422
30	Paints and allied prod.	0.0773	0.2232	0.0508	0.1733	0.0643	0.1884
31	Petroleum refining and related prod.	0.0695	0.1743	0.0382	0.2139	0.0619	0.1864
32	Rubber and misc. plastics prod.	0.0552	0.2039	0.0512	0.1764	0.0674	0.1855
33	Leather tanning and finishing	--	--	--	--	--	--
34	Footwear and other leather prod.	0.0518	0.2491	0.0619	0.1890	0.0820	0.2340
35	Glass and glass prod.	0.0671	0.2662	0.0552	0.1680	0.0730	0.1740
36	Stone and clay prod.	0.0402	0.2224	0.0576	0.1686	0.0547	0.1917
37	Primary iron and steel manuf.	0.0052	0.2337	0.0588	0.1698	0.0562	0.1876
38	Primary nonferrous metals manuf.	0.0281	0.2631	0.0545	0.1676	0.0583	0.1877
39	Metal containers	0.0667	0.2272	0.0293	0.2118	0.0769	0.1572
40	Heating, plumbing, fab. str. metal prod.	0.0558	0.2144	0.0352	0.1994	0.0616	0.1958
41	Screw machine prod. and stampings	0.0498	0.2429	0.0310	0.2014	0.0616	0.1917
42	Other fabricated metal prod.	0.0650	0.2023	0.0410	0.1927	0.0680	0.1921
43	Engines and turbines	0.0332	0.2956	0.0378	0.1961	0.0586	0.1747
44	Farm and garden machinery	0.0598	0.2233	0.0424	0.2010	0.0643	0.2327
45	Construction and mining machinery	0.0600	0.2330	0.0439	0.1911	0.0894	0.2529
46	Mat. handling machinery, equip.	0.0602	0.2868	0.0493	0.1902	0.0799	0.2090
47	Metalworking machinery, equip.	0.0426	0.2441	0.0480	0.1897	0.0553	0.1907
48	Spec. industry machinery, equip.	0.0542	0.3481	0.0510	0.1909	0.0671	0.1877
49	General industrial machinery, equip.	0.0581	0.2040	0.0450	0.1931	0.0556	0.1839
50	Misc. machinery, exc. electrical	0.0491	0.2790	0.0467	0.1940	0.0598	0.1931
51	Computer and office equip.	0.0565	0.2560	0.0720	0.2161	0.0794	0.2216
52	Service industry machinery	0.0618	0.2322	0.0500	0.1919	0.0608	0.2075
53	Electrical industrial equip., apparatus	0.0726	0.2360	0.0534	0.1933	0.0554	0.1959
54	Household appliances	0.0487	0.2365	0.0523	0.1867	0.0934	0.2614

Table I

Summary Statistics

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		Industry return		Upstream return		Downstream return	
Industry	**Industry name**	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**
55	Electric lighting and wiring equip.	0.0448	0.2192	0.0524	0.1886	0.0704	0.2032
56	Audio, video, communication equip.	0.0548	0.2964	0.0830	0.2399	0.0569	0.1627
57	Electronic components and acc.	0.1052	0.3270	0.0556	0.1814	0.0625	0.2089
58	Misc. electrical machinery and supp.	0.0406	0.2600	0.0629	0.1978	0.0604	0.1905
59	Motor vehicles and equip.	0.0479	0.2226	0.0558	0.1932	0.0912	0.2622
60	Aircraft and parts	0.0728	0.2340	0.0572	0.1973	0.0654	0.1921
61	Other transportation equip.	0.0842	0.2537	0.0526	0.1922	0.0626	0.2005
62	Scientific and controlling instruments	0.0577	0.2082	0.0704	0.2100	0.0739	0.2276
63	Ophthalmic and photographic equip.	0.0368	0.2121	0.0697	0.1976	0.0797	0.2085
64	Miscellaneous manuf.	0.0389	0.2405	0.0594	0.1914	0.0794	0.2166
65	Transportation and warehousing	0.0571	0.2104	0.0691	0.1734	0.0630	0.1704
66	Communications, exc. radio and TV	0.0389	0.1696	0.0718	0.2136	0.0718	0.1978
67	Radio and TV broadcasting	0.1192	0.2369	0.0600	0.2321	0.0863	0.2546
68	Electric, gas, water, sanitary services	0.0318	0.1417	0.0706	0.2073	0.0613	0.1819
69	Wholesale and retail trade	--	--	--	--	--	--
70	Finance and insurance	0.0694	0.1912	0.0655	0.2003	0.0515	0.1933
71	Real estate and rental	0.0083	0.2396	0.0850	0.2294	0.0734	0.2054
72	Hotels, personal, repair serv. (exc. auto)	0.1051	0.3138	0.0623	0.1852	0.0698	0.1978
73	Business and professional services	0.0863	0.2546	0.0572	0.1825	0.0638	0.1858
74	Eating and drinking places	0.0704	0.2222	0.0678	0.1605	0.0643	0.1926
75	Automotive repair and services	0.1008	0.3101	0.0584	0.1759	0.0665	0.1923
76	Amusements	0.0589	0.2648	0.0638	0.1977	0.1046	0.2126
77	Health, educ., social serv., nonprofits	0.0853	0.3087	0.0570	0.1828	0.0726	0.1934
	Number of industries	65					
	Mean	0.0623	0.2456	0.0558	0.1905	0.0666	0.2016
	Standard deviation	0.0228	0.0521	0.0111	0.0165	0.0129	0.0263
	Minimum	0.0052	0.1417	0.0293	0.1602	0.0305	0.1381
	Maximum	0.1192	0.4293	0.0850	0.2399	0.1046	0.2622

Table II

Panel Regressions

This table presents results from panel regressions of excess monthly industry returns on contemporaneous and lagged variables. Industry definition is based on industry account definitions of the Input-Output Benchmark Survey of the Bureau of Economic Analysis. Upstream (downstream) returns consist of upstream (downstream) industry returns and are weighted using inter-industry flow of goods and services reported in the Survey. All regressions include year-month fixed effects. t-statistics are in parentheses. Underlying standard errors are robust and clustered by year-month.

	(1)	(2)	(3)	(4)
$R_{upstream,t}$	0.3353		0.3332	0.3283
	(15.81)		(15.62)	(15.00)
$R_{downstream,t}$	0.2084		0.2067	0.2040
	(13.26)		(13.11)	(12.91)
$R_{industry,t-1}$		0.0363	0.0304	0.0259
		(2.42)	(2.11)	(1.79)
$R_{upstream,t-1}$				0.0575
				(2.55)
$R_{downstream,t-1}$				0.0380
				(2.44)
R^2	0.5378	0.5260	0.5382	0.5386
N obs	31,135	31,135	31,135	31,135

Table III

Fama-MacBeth Regressions

This table presents average coefficient estimates from monthly cross-sectional regressions of excess monthly industry returns in Panel A and stock returns in Panels B and C. Standard errors assume independence across monthly cross-sectional regressions. Industry definition is based on industry account definitions of the Input-Output Benchmark Survey of the Bureau of Economic Analysis. Upstream (downstream) returns consist of upstream (downstream) industry returns and are weighted using inter-industry flow of goods and services reported in the Survey. Stock-specific customer returns in Panel C are based on Compustat customer files (1999-2002) and are weighted using reported sales amounts.

Panel A: Industry-Level Regressions

	(1)	(2)	(3)	(4)
Constant	0.0049	0.0051	0.0058	0.0053
	(2.07)	(1.93)	(2.26)	(1.82)
$R_{industry,t-1}$	0.0474			0.0407
	(4.26)			(3.75)
$R_{upstream,t-1}$		0.1246		0.1036
		(5.45)		(4.77)
$R_{downstream,t-1}$			0.0727	0.0570
			(4.33)	(3.57)
Mean R^2	0.0511	0.0239	0.0252	0.0919

Table III

Fama-MacBeth Regressions

This table presents average coefficient estimates from monthly cross-sectional regressions of excess monthly industry returns in Panel A and stock returns in Panels B and C. Standard errors assume independence across monthly cross-sectional regressions. Industry definition is based on industry account definitions of the Input-Output Benchmark Survey of the Bureau of Economic Analysis. Upstream (downstream) returns consist of upstream (downstream) industry returns and are weighted using inter-industry flow of goods and services reported in the Survey. Stock-specific customer returns in Panel C are based on Compustat customer files (1999-2002) and are weighted using reported sales amounts.

Panel B: Stock-Level Regressions

	(1)	(2)	(3)	(4)
Constant	0.0040	0.0042	0.0045	0.0040
	(1.36)	(1.51)	(1.62)	(1.49)
$R_{industry,t-1}$	0.1299	0.1246	0.1224	0.1484
	(11.22)	(11.92)	(11.90)	(15.66)
$R_{upstream,t-1}$	0.0879	0.0885	0.0827	0.0861
	(4.03)	(4.24)	(4.00)	(4.19)
$R_{downstream,t-1}$	0.0513	0.0483	0.0460	0.0541
	(2.50)	(2.44)	(2.35)	(2.77)
$R_{stock,t-4:t-9}$		0.0064		
		(2.51)		
$R_{stock,t-2:t-12}$			0.0075	0.0076
			(4.05)	(4.23)
$R_{stock,t-1}$				-0.0653
				(14.59)
Mean R^2	0.0110	0.0202	0.0223	0.0316

Table III
Fama-MacBeth Regressions

This table presents average coefficient estimates from monthly cross-sectional regressions of excess monthly industry returns in Panel A and stock returns in Panels B and C. Standard errors assume independence across monthly cross-sectional regressions. Industry definition is based on industry account definitions of the Input-Output Benchmark Survey of the Bureau of Economic Analysis. Upstream (downstream) returns consist of upstream (downstream) industry returns and are weighted using inter-industry flow of goods and services reported in the Survey. Stock-specific customer returns in Panel C are based on Compustat customer files (1999-2002) and are weighted using reported sales amounts.

Panel C: Stock-Level Regressions with Stock-Specific Customer Returns (1999-2002)

	(1)	(2)	(3)	(4)
Constant	0.0116	0.0159	0.0099	0.0109
	(0.81)	(0.91)	(0.77)	(0.73)
$R_{specific\ customer,t-1:t-3}$	0.0363			0.0322
	(2.30)			(2.64)
$R_{industry,t-1}$		0.1270		0.1510
		(1.82)		(2.85)
$R_{upstream,t-1}$		0.2360		0.2157
		(1.70)		(1.72)
$R_{downstream,t-1}$		0.2770		0.2211
		(2.97)		(2.54)
$R_{stock,t-2:t-12}$			0.0020	0.0007
			(0.25)	(0.10)
$R_{stock,t-1}$			-0.0454	-0.0579
			(2.03)	(2.84)
Mean R^2	0.0095	0.0259	0.0402	0.0640

Table IV

Portfolio Returns

This table reports mean and standard deviation of annualized excess one-month returns on portfolios of industries formed on the basis of related industry returns in the previous month in Panels A and B, and on portfolios of stocks formed on the basis of stock-specific customer returns in the previous three month period in Panel C. Industries are sorted into five bins at the beginning of each month according to previous month upstream returns in Panel A and downstream returns in Panel B. Stocks are sorted into five bins at the beginning of each month according to stock-specific customer returns in the previous three month period in Panel C. Equal-weighted and value-weighted portfolios are formed for each of the five bins. Value-weighted portfolios use the market capitalization of industries at the end of the previous month in Panels A and B, and the market capitalization of stocks at the end of the previous month in Panel C. Self-financing trading strategies reported in the last column consist of buying the high bin portfolio (top quintile) and selling the low bin portfolio (bottom quintile).

Panel A: Upstream strategy

	Industries sorted according to previous month upstream return					
	Low (1)	(2)	(3)	(4)	High (5)	H - L
EW mean return (annualized)	0.029	0.051	0.060	0.074	0.097	0.068
Standard deviation	0.183	0.192	0.191	0.187	0.186	0.080
Sharpe ratio	0.157	0.268	0.316	0.396	0.521	0.852
VW mean return (annualized)	0.016	0.055	0.059	0.055	0.081	0.065
Standard deviation	0.165	0.180	0.179	0.181	0.173	0.113
Sharpe ratio	0.099	0.303	0.330	0.306	0.471	0.573

Panel B: Downstream strategy

	Industries sorted according to previous month downstream return					
	Low (1)	(2)	(3)	(4)	High (5)	H - L
EW mean return (annualized)	0.030	0.048	0.063	0.084	0.086	0.056
Standard deviation	0.185	0.190	0.187	0.190	0.187	0.081
Sharpe ratio	0.161	0.256	0.339	0.441	0.460	0.696
VW mean return (annualized)	0.009	0.048	0.064	0.073	0.070	0.060
Standard deviation	0.180	0.167	0.168	0.172	0.186	0.137
Sharpe ratio	0.052	0.287	0.383	0.423	0.374	0.440

Panel C: Stock-specific customer strategy (1999-2002)

	Stocks sorted according to previous three month customer return					
	Low (1)	(2)	(3)	(4)	High (5)	H - L
EW mean return (annualized)	-0.009	0.204	0.101	0.203	0.366	0.374
Standard deviation	0.417	0.325	0.322	0.304	0.401	0.340
Sharpe ratio	-0.021	0.626	0.315	0.669	0.911	1.103
VW mean return (annualized)	-0.148	-0.080	-0.089	0.018	0.273	0.421
Standard deviation	0.417	0.310	0.272	0.290	0.448	0.434
Sharpe ratio	-0.354	-0.257	-0.327	0.063	0.610	0.969

Table V

Cross-Industry Momentum Diagnostics: Industry Inclusion Probabilities

This table presents the frequency with which industries enter the short and long portfolios of momentum strategies based on previous month related industry returns. At the beginning of each month, industries are sorted into five bins according to previous month upstream or downstream returns. An industry enters the short (long) portfolio if the industry's previous month related industry return is in the bottom (top) quintile. Reported is the number of months an industry enters a given portfolio-strategy combination divided by 479 (the number of trading months, February 1963 to December 2002).

		Upstream strategy		**Downstream strategy**	
Industry	**Industry Name**	*Low*	*High*	*Low*	*High*
1	Livestock and livestock products	--	--	--	--
2	Other agricultural products	--	--	--	--
3	Forestry and fishery products	--	--	--	--
4	Agricultural, forestry, and fishery services	--	--	--	--
5	Iron and ferroalloy ores mining	--	--	--	--
6	Nonferrous ores mining	0.010	0.012	0.033	0.024
7	Coal mining	0.011	0.012	0.029	0.024
8	Crude petroleum and natural gas	0.027	0.023	0.028	0.028
9	Stone and clay mining and quarrying	--	--	--	--
10	Chemical and fertilizer mineral mining	--	--	--	--
11	New construction	--	--	--	--
12	Maintenance and repair construction	0.010	0.007	0.019	0.014
13	Ordnance and accessories	0.017	0.018	0.017	0.015
14	Food and kindred products	0.010	0.013	0.024	0.024
15	Tobacco products	--	--	--	--
16	Broad and narrow fabrics, yarn and thread mills	0.025	0.023	0.023	0.024
17	Miscellaneous textile goods and floor coverings	0.025	0.023	0.019	0.018
18	Apparel	0.029	0.025	0.018	0.022
19	Miscellaneous fabricated textile products	0.026	0.025	0.016	0.015
20	Lumber and wood products, except containers	0.003	0.005	0.014	0.013
21	Wood containers	--	--	--	--
22	Household furniture	0.019	0.020	0.027	0.026
23	Other furniture and fixtures	0.012	0.013	0.030	0.028
24	Paper and allied products, except containers	0.012	0.013	0.015	0.016
25	Paperboard containers and boxes	0.024	0.024	0.013	0.016
26	Printing and publishing	0.015	0.017	0.019	0.020
27	Chemicals and selected chemical products	0.013	0.014	0.011	0.012
28	Plastics and synthetic materials	0.016	0.016	0.018	0.016
29	Drugs, cleaning and toilet preparations	0.006	0.008	0.025	0.026
30	Paints and allied products	0.018	0.020	0.010	0.011
31	Petroleum refining and related products	0.031	0.029	0.012	0.013
32	Rubber and miscellaneous plastics products	0.022	0.019	0.001	0.001
33	Leather tanning and finishing	--	--	--	--
34	Footwear and other leather products	0.015	0.017	0.022	0.022
35	Glass and glass products	0.011	0.010	0.006	0.009
36	Stone and clay products	0.010	0.011	0.008	0.005
37	Primary iron and steel manufacturing	0.011	0.011	0.011	0.011
38	Primary nonferrous metals manufacturing	0.023	0.019	0.008	0.008
39	Metal containers	0.032	0.022	0.023	0.028
40	Heating, plumbing, and fabricated structural metal products	0.023	0.017	0.013	0.013
41	Screw machine products and stampings	0.024	0.017	0.016	0.016
42	Other fabricated metal products	0.013	0.010	0.005	0.006
43	Engines and turbines	0.020	0.015	0.019	0.017
44	Farm and garden machinery	0.017	0.013	0.023	0.021
45	Construction and mining machinery	0.013	0.010	0.031	0.030
46	Materials handling machinery and equipment	0.006	0.007	0.018	0.019
47	Metalworking machinery and equipment	0.008	0.005	0.009	0.006
48	Special industry machinery and equipment	0.008	0.007	0.007	0.010
49	General industrial machinery and equipment	0.010	0.009	0.010	0.006
50	Miscellaneous machinery, except electrical	0.008	0.004	0.010	0.008

Table V

Cross-Industry Momentum Diagnostics: Industry Inclusion Probabilities

This table presents the frequency with which industries enter the short and long portfolios of momentum strategies based on previous month related industry returns. At the beginning of each month, industries are sorted into five bins according to previous month upstream or downstream returns. An industry enters the short (long) portfolio if the industry's previous month related industry return is in the bottom (top) quintile. Reported is the number of months an industry enters a given portfolio-strategy combination divided by 479 (the number of trading months, February 1963 to December 2002).

		Upstream strategy		**Downstream strategy**	
Industry	**Industry Name**	*Low*	*High*	*Low*	*High*
51	Computer and office equipment	0.021	0.024	0.017	0.019
52	Service industry machinery	0.008	0.008	0.025	0.025
53	Electrical industrial equipment and apparatus	0.004	0.005	0.012	0.009
54	Household appliances	0.003	0.004	0.026	0.027
55	Electric lighting and wiring equipment	0.005	0.005	0.007	0.009
56	Audio, video, and communication equipment	0.025	0.031	0.020	0.017
57	Electronic components and accessories	0.004	0.004	0.017	0.016
58	Miscellaneous electrical machinery and supplies	0.011	0.012	0.015	0.015
59	Motor vehicles and equipment	0.008	0.012	0.027	0.028
60	Aircraft and parts	0.010	0.010	0.022	0.020
61	Other transportation equipment	0.008	0.009	0.019	0.017
62	Scientific and controlling instruments	0.019	0.021	0.022	0.024
63	Ophthalmic and photographic equipment	0.015	0.020	0.011	0.014
64	Miscellaneous manufacturing	0.003	0.003	0.012	0.015
65	Transportation and warehousing	0.014	0.019	0.002	0.004
66	Communications, except radio and TV	0.022	0.024	0.003	0.003
67	Radio and TV broadcasting	0.028	0.025	0.024	0.025
68	Electric, gas, water, and sanitary services	0.025	0.028	0.001	0.002
69	Wholesale and retail trade	--	--	--	--
70	Finance and insurance	0.018	0.020	0.011	0.010
71	Real estate and rental	0.025	0.030	0.014	0.013
72	Hotels, personal and repair services (except auto)	0.012	0.013	0.003	0.003
73	Business and professional services	0.014	0.016	0.002	0.003
74	Eating and drinking places	0.020	0.024	0.002	0.004
75	Automotive repair and services	0.011	0.013	0.001	0.001
76	Amusements	0.018	0.019	0.020	0.029
77	Health, educational, and social services and nonprofits	0.015	0.015	0.005	0.008
	Mean	0.015	0.015	0.015	0.015
	Standard deviation	0.008	0.007	0.008	0.008
	Number of industries	65	65	65	65
	Minimum	0.003	0.003	0.001	0.001
	Maximum	0.032	0.031	0.033	0.030

Table VI

Cross-Industry Momentum Diagnostics: Return Factor Exposure

This table presents the exposure of monthly cross-industry momentum returns to contemporaneous monthly CRSP value-weighted market return (in excess of the one-month Treasury bill rate observed at the beginning of the month), Fama-French SMB and HML factors, and Carhart MOM factor. NBER recession is an indicator variable equal to one if the month falls within a NBER recession period.

Momentum strategy:	Upstream	Downstream	Upstream	Downstream
Alpha	0.0048	0.0041	0.0040	0.0040
	(4.25)	(3.61)	(3.26)	(3.25)
$R_{market} - R_f$	0.0183	0.0228	0.0192	0.0137
	(0.71)	(0.87)	(0.65)	(0.46)
SMB	0.0277	-0.0058	0.0557	-0.0030
	(0.78)	(0.16)	(1.40)	(0.07)
HML	-0.0149	-0.0221	-0.0184	-0.0497
	(0.38)	(0.56)	(0.42)	(1.12)
MOM	0.0887	0.0600	0.0751	0.0209
	(3.08)	(2.05)	(2.20)	(0.60)
NBER recession			0.0056	0.0021
			(1.81)	(0.66)
$(R_{market} - R_f)$ * NBER recession*			0.0324	0.0760
			(0.51)	(1.18)
*SMB * NBER recession*			-0.1324	0.0371
			(1.41)	(0.39)
*HML * NBER recession*			0.0119	0.0647
			(0.11)	(0.60)
*MOM * NBER recession*			0.0251	0.1785
			(0.35)	(2.43)
R^2	0.0303	0.0164	0.0433	0.0328
N obs	479	479	479	479

Table VII

Cross-Industry Momentum Diagnostics: Excluding Micro Stocks

The analysis in this table excludes micro stocks. Specifically, industry returns and related industry returns that underlie the analysis are recalculated excluding stocks with a market capitalization below the 20th percentile of NYSE firms. Reported are mean and standard deviation of annualized excess one-month returns on portfolios of industries formed on the basis of related industry returns in the previous month. Industries are sorted into five bins at the beginning of each month according to previous month upstream returns in Panel A and downstream returns in Panel B. Equal-weighted and value-weighted portfolios are formed for each of the five bins. Value-weighted portfolios use the market capitalization of industries at the end of the previous month. Self-financing trading strategies reported in the last column consist of buying the high bin portfolio (comprised of industries with previous month related industry returns in the top quintile) and selling the low bin portfolio (comprised of industries with previous month related industry returns in the bottom quintile).

Panel A: Upstream portfolios

	Industries sorted according to previous month upstream return					
	Low (1)	(2)	(3)	(4)	High (5)	H - L
EW mean return (annualized)	0.041	0.041	0.061	0.060	0.096	0.055
Standard deviation	0.186	0.184	0.185	0.184	0.184	0.089
Sharpe ratio	0.223	0.221	0.331	0.324	0.523	0.617
VW mean return (annualized)	0.026	0.041	0.064	0.047	0.080	0.053
Standard deviation	0.167	0.172	0.179	0.170	0.173	0.117
Sharpe ratio	0.157	0.239	0.357	0.273	0.461	0.456

Panel B: Downstream portfolios

	Industries sorted according to previous month downstream return					
	Low (1)	(2)	(3)	(4)	High (5)	H - L
EW mean return (annualized)	0.036	0.045	0.057	0.072	0.088	0.051
Standard deviation	0.183	0.186	0.186	0.182	0.182	0.078
Sharpe ratio	0.198	0.244	0.303	0.396	0.481	0.659
VW mean return (annualized)	0.033	0.042	0.040	0.066	0.074	0.040
Standard deviation	0.176	0.167	0.166	0.162	0.186	0.125
Sharpe ratio	0.189	0.249	0.237	0.408	0.395	0.322

Table VIII

Longer Formation and Holding Periods

This table reports the profitability of cross-industry momentum strategies with longer formation and holding periods. Specifically, at the beginning of each month, industries are sorted into five bins according to their previous J-month related industry returns. The self-financing trading strategy then buys the high bin portfolio (comprised of industries with previous J-month related industry returns in the top quintile), sells the low bin portfolio (comprised of industries with previous J-month related industry returns in the bottom quintile) and holds the position for K months. As a result, in any given month, the strategy holds a series of K portfolios that are selected in that month and as far back as K-1 months ago. Both equal-weighted and value-weighted strategies are considered. Value-weighted strategies use the market capitalization of industries at the time of portfolio formation. Panel A and B present mean annualized monthly returns from trading strategies based on upstream and downstream returns, respectively. t-statistics are in parentheses.

Panel A: Upstream strategy

	Equal-weighted				*Value-weighted*			
J	K = 1	3	6	12	1	3	6	12
1	0.068	0.040	0.022	0.016	0.065	0.029	0.008	0.010
	(5.38)	(4.69)	(3.15)	(3.02)	(3.62)	(2.39)	(0.91)	(1.59)
3	0.049	0.034	0.022	0.015	0.018	0.009	-0.003	0.003
	(3.54)	(2.94)	(2.21)	(1.92)	(0.88)	(0.57)	(0.27)	(0.33)
6	0.041	0.029	0.026	0.014	0.001	-0.005	0.004	0.006
	(2.80)	(2.22)	(2.21)	(1.39)	(0.06)	(0.28)	(0.29)	(0.51)
12	0.049	0.034	0.021	0.006	0.028	0.012	0.002	-0.007
	(3.49)	(2.43)	(1.62)	(0.55)	(1.43)	(0.68)	(0.14)	(0.51)

Panel B: Downstream strategy

	Equal-weighted				*Value-weighted*			
J	K = 1	3	6	12	1	3	6	12
1	0.056	0.018	0.010	0.012	0.060	0.014	0.011	0.019
	(4.40)	(2.18)	(1.66)	(2.81)	(2.78)	(1.03)	(1.04)	(2.25)
3	0.030	0.016	0.015	0.015	0.033	0.028	0.028	0.030
	(2.30)	(1.47)	(1.71)	(2.24)	(1.48)	(1.45)	(1.84)	(2.45)
6	0.031	0.022	0.027	0.018	0.044	0.039	0.047	0.035
	(2.33)	(1.86)	(2.47)	(2.08)	(1.92)	(1.87)	(2.44)	(2.06)
12	0.040	0.031	0.023	0.011	0.061	0.051	0.038	0.024
	(2.91)	(2.44)	(1.96)	(1.11)	(2.68)	(2.36)	(1.82)	(1.22)

Table IX

Robustness Checks

This table presents panel regressions of excess monthly industry returns on indicator variables proxying for trading strategies based on previous month own, upstream and downstream industry returns. Specifically, an indicator variable for the long positions of a trading strategy takes on the value of one if the previous month return on which the strategy is based is in the top quintile of the distribution in a given month. Similarly, an indicator variable for the short positions of a trading strategy takes on the value of one if the previous month return on which the strategy is based is in the bottom quintile of the distribution in a given month. Industry definition is based on industry account definitions of the Input-Output Benchmark Survey of the Bureau of Economic Analysis. Upstream (downstream) returns consist of upstream (downstream) industry returns and are weighted using inter-industry flow of goods and services reported in the Survey. Column 5 excludes the month of January. Columns 6 and 7 split the sample into two halves, 1963-1982 and 1983-2002. All regressions include month fixed effects. t-statistics are in parentheses. Underlying standard errors are robust and clustered by month.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$1\,[R_{industry,t-1} \geq p_{80\%,t-1}]$	0.0019			0.0016	0.0017	0.0035	-0.0003
	(1.79)			(1.55)	(1.58)	(2.63)	(0.16)
$1\,[R_{industry,t-1} \leq p_{20\%,t-1}]$	-0.0035			-0.0031	-0.0035	-0.0033	-0.0029
	(3.42)			(3.04)	(3.28)	(2.92)	(1.72)
$1\,[R_{upstream,t-1} \geq p_{80\%,t-1}]$		0.0029		0.0026	0.0027	0.0009	0.0042
		(3.29)		(2.96)	(2.95)	(0.88)	(3.02)
$1\,[R_{upstream,t-1} \leq p_{20\%,t-1}]$		-0.0028		-0.0024	-0.0019	-0.0044	-0.0004
		(3.45)		(3.03)	(2.28)	(4.32)	(0.34)
$1\,[R_{downstream,t-1} \geq p_{80\%,t-1}]$			0.0017	0.0013	0.0016	0.0006	0.0022
			(2.11)	(1.70)	(1.97)	(0.54)	(1.84)
$1\,[R_{downstream,t-1} \leq p_{20\%,t-1}]$			-0.0030	-0.0025	-0.0026	-0.0028	-0.0023
			(3.72)	(3.25)	(3.28)	(2.64)	(2.02)
R^2	0.53	0.53	0.53	0.53	0.52	0.61	0.45
N obs	31,135	31,135	31,135	31,135	28,600	15,535	15,600