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A Fundamental Analysis of Customer/Supplier Relationships

Cohen & Frazzini (2008): A Profitability Problem?

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Abstract

This thesis looks at the fundamental differences between customers and suppliers in relation to Cohen & Frazzini (2008) and investigates whether profitability could be a significant factor affecting their customer momentum returns. The paper shows that the average customer is larger in size and has higher profitability. These differences are statistically significant and persistent over time. Furthermore I show that customer –and supplier profitability is correlated, and that the suppliers that are linked to high (low) profitability customer firms also have high (low) profitability. Given that profitability is known to cause return predictability, I propose that profitability could be a significant factor explaining the customer momentum suggested by Cohen & Frazzini (2008).

Preface

After participating on NBIM's NFI summer school program in 2013, I decided that I wanted to do a master thesis within asset pricing. During the program, I studied Cohen & Frazzini (2008)'s paper on customer momentum, and was curious to know whether I could utilize the paper to form a master thesis. The original thought was to perform a replica of their trading strategy using updated data. With the time constraint and the level of difficulty of performing such an empirical analysis, I, in conjunction with my professor, decided that I needed to take a different route. Some work had already been performed on the fundamental analysis, so I decided to build on what I already had and write a master thesis that was more on the cross junction of corporate finance and asset pricing. What was important to me when choosing a theme was that it needed to be original. Luckily, I managed to maintain this even though I changed the scope of the thesis.

I would like to thank my professor Michael Kisser, for excellent guidance and advice, and for being so supportive during the time where I redirected my research objective. Moreover, I would like to add a special thanks to Prof. Jarrad Harford for providing me with an updated dataset containing economic links. Lastly, I also want to thank Assistant Prof. Francisco Santos for the early discussions on my master thesis.

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1. Introduction

Cohen & Frazzini (2008) find return predictability amongst assets that are economically linked through the supply chain. Specifically, a customer momentum strategy that involves purchasing (selling) supplier stocks whose customers have experienced a positive (negative) shock to their share price, will earn abnormal returns. When a firm is listed as a major customer in a supplier firm, any shock to a customer's stock price should also have an effect on the supplier, both in real quantities and stock price. If investors fail to consider these important economic links, prices can generate return predictability. It is in this way that Cohen & Frazzini (2008) argue that the anomaly stems from investor attention.

This paper will investigate whether customers and suppliers differ systematically along a set of variables known to affect asset returns. Moreover, it will investigate whether profitability could be a significant factor affecting the customer momentum result by Cohen & Frazzini (2008). Looking at the fundamental difference between customers and suppliers provides some interesting results. While there tend to be only moderate differences in book-to-market and leverage ratios between customers and suppliers, the results indicate a large difference in terms of size and profitability. Specifically, the average customer is significantly larger than the average supplier and has a considerable higher level of profitability. Part of the difference in size however, can be justified by the data generating process[1]. Profitability on the other hand, is more puzzling. I did find however, that the difference in profitability actually comes from firm size, as SG&A expenses are found to be much larger for smaller firms than larger firms. Given that the average supplier is much smaller than the customer, I find size to explain the difference in profitability.

Even though customers (on average) outperform suppliers with respect to profitability, it is difficult to rationalise customer momentum using this difference in profitability. In order to link profitability to the findings by Cohen & Frazzini (2008) the analysis will therefore focus on profitability in general, and how this might affect customer/supplier return predictability. I find significant evidence that customer –and supplier profitability is correlated, but find the correlation to happen within the same year (customer profitability at time *t* with supplier

[1] Suppliers are required to report the identity of customer representing more than 10% of annual sales.

profitability at time *t*). Using a lag between customer –and supplier profitability significantly reduces the correlation. I also find evidence that shocks to customer profitability induce a reaction to supplier profitability in the same direction, however the results were deemed statistically insignificant. I lastly find that the suppliers linked to high profitability firms significantly outperform suppliers linked to low profitability firms.

Cohen & Frazzini (2008) find evidence that customers and suppliers are, in addition to stock returns, correlated in terms of profits. I find them to be correlated in terms of profitability as well. Moreover, several studies have shown that profitability is in fact related to asset returns. Combining all of this yields an interesting question; can profitability be a significant factor affecting asset returns in the customer momentum strategy? Assume that the high (low) customer return stocks that Cohen & Frazzini (2008) use to form portfolios of supplier stocks, also have high (low) profitability. Given that the linked suppliers also tend to have high (low) profitability, and that there exists a profitability premium in asset markets, this can in return induce return predictability across stocks that are economically linked. My objective in this paper is not to prove that customer momentum is explained by profitability, rather propose an alternative explanation to the anomaly that could open up for further research. I conclude that the profitability correlation between customers and suppliers can be a significant factor affecting customer momentum, and suggest the use of a profitability factor loading (similar to Fama & French (2014)) in future evaluations of the customer momentum strategy.

The paper will be organised as follows. First, I will provide a detailed description of the Cohen & Frazzini (2008) paper, where I will go through the trading strategy and its robustness tests. Following this, I will provide the reader with some related research on economic links and predictable returns. I will then provide some background material on efficient markets, asset pricing models and factor loadings, as well as provide the reader with a detailed literary review on limited attention and information diffusion. I will then move on to a description of my dataset, followed by an analysis of how customers and suppliers differ systematically across variables known to influence asset prices. In the last two sections I will provide the reader with an analysis of customer/supplier profitability correlations, as well as a discussion on whether profitability should be considered for further research within customer momentum.

2. Background and Litterary Review

2.1 Summary of Cohen & Frazzini (2008)

Cohen & Frazzini (2008) find return predictability amongst assets that are economically linked and study customer-supplier relations at the *firm level* from 1980-2004. They are able to extract information about firms' principal customers due to Regulation SFAS NO. 131, which requires all firms to report the identity of any customer representing more than 10% of total reported sales, profits or losses. They perform a trading strategy, which involves purchasing and selling supplier stocks whose customers had experienced a shock to their share price.

The concept may be best explained by an example suggested by Cohen & Frazzini (2008). Take Coastcast Corporation, a leading supplier of golf club heads, and Callaway Golf Corporation, a company that provides golf equipment. Callaway was a significant stakeholder in Coastcast, and represented 50% of Coastcast's total sales. In June 2001, Callaway lowered second quarter revenue projections by half, which subsequently led analysts cutting EPS forecasts by half as well. This had a significant effect on Callaway's stock price, whose market value dropped by 30% in 2 days. Despite the significant downturn in the market value of its major customer, the reaction to Coastcast stock price was not seen until 2 months later (Cohen & Frazzini, 2008). Had one shorted the Coastcast stock at the time of the drop in Callaway stock price, one could have made significant profits.

Cohen & Frazzini (2008) refer to their findings as customer momentum, namely that there is return predictability amongst assets that are linked through the supply chain. This return is puzzling, as it is expected that any rational investor would update their expectations of the supplier stock whenever news about the related major customer is released into the market. Given that information on a supplier's major customers is clearly and contractually stated in suppliers' financial reports, this significantly challenges traditional asset pricing theory and EMH. They test the following hypothesis:

Limited Attention Hypothesis: "*Stock prices underreact to firm-specific information that induces changes in valuation of related firms, generating return predictability across assets. In particular, stock prices underreact to negative (positive) news involving related firms,*

and in return generate negative (positive) subsequent price drift" (Cohen & Frazzini, 2008, pp.1985).

They argue that their customer momentum findings stems from investor inattention and investors' slow reaction to update expectations about related firms.

2.1.1 Trading Strategy and Result

Cohen & Frazzini (2008) utilize monthly stock returns, and form calendar-time portfolios based on one-month lagged customer returns. In month (*t)*, they rank each supplier stock in ascending order based on the customer return in (*t-1)*, and assign each supplier stock to one of five quintile portfolios (Cohen & Frazzini, 2008). The lowest quintile portfolio consists of the supplier stocks whose customers have performed the worst, whereas the highest quintile portfolio only contains the supplier stocks whose customers that have performed the best. Every month, they sort the supplier portfolio based on last month's customer return, and rebalance every month in order to maintain value/equal weights. Moreover, Cohen & Frazzini (2008) drop all observations with a closing price trading below $5, and all observations with non-missing customer or supplier returns in (*t-1)* and (*t)*. [2]

Cohen & Frazzini (2008) perform a long-short trading strategy that involves longing the supplier portfolio consisting of the top 20% performing customer stocks, and shorting the supplier portfolio consisting of the bottom 20% customer stocks. The customer momentum strategy performed by Cohen & Frazzini (2008) yields a statistically significant Fama & French (1993) monthly abnormal return of 1.45%. This translates to a yearly return of 18.4%. Augmenting the model to include Carhart (1997)'s own stock momentum factor, and adjusting for Pastor & Stambaugh (2003)'s liquidity factor, has little effect on the result. The strategy would then earn an abnormal monthly return of 1.37% and 1.25%, respectively. Cohen & Frazzini (2008) show that even after controlling for past returns and liquidity, suppliers with positive customer shocks outperform suppliers with negative customer shocks.

[2] Ensures that returns are not driven by microcapitalization illiquid securities (Cohen & Frazzini, 2008)

2.1.2 Robustness Tests

Cohen & Frazzini (2008) discuss several possible explanations to the positive alphas gained in the long-short trading strategy, and conduct a number of robustness tests. They suggest that nonsynchronous trading, liquidity, characteristics and size can help explain the anomaly. They first present a possibility that the customer momentum strategy could be subject to a lead-lag effect due to the relatively large size of the average customer. Cohen & Frazzini (2008) therefore drop all supplier firms in the portfolio whose customer had a higher turnover, higher number of analysts covering it, and higher level of institutional ownership. This significantly reduces the sample size, however still yields in an abnormal monthly return of 1.37% (Cohen & Frazzini, 2008). This suggests that the lead-lag effect is not an issue.

Nonsynchronous trading could also be problem, as it can generate positive autocorrelation across stocks. Given that Cohen & Frazzini (2008) use monthly data and choose to exclude any stocks in their portfolio being traded below $5, nonsynchronous trading is unlikely to be an issue. In order to account for a possible liquidity problem, Cohen & Frazzini (2008) exclude all stocks that lack strictly positive trading volume. The results however, were left unaffected by this adjustment. Cohen & Frazzini (2008) use Daniel & Titman (1997)'s idea of using characteristics to explain the returns, and therefore subtract from each stock, returns matched on market equity, market to book and the prior 1-year quintiles. Moreover, they industry adjust the returns with Fama & French (1997)'s 48 industry portfolios. None of the adjustments however, can explain the abnormal returns. They proceed by attempting to split the sample into smaller and larger firms, but again, do not affect the overall result. With respect to size, Cohen & Frazzini (2008) find that the monthly drift of the supplier after a customer shock was equally large for small and large caps, however find that large caps tended to converge faster.

Several authors have researched variables that could explain commonalities of asset returns. Cohen & Frazzini (2008) utilize Fama & MacBeth (1973) cross-sectional regressions in order to control for different effects observed in asset pricing. First, in order to control for Jagadeesh (1990) and Jagadeesh & Titman (1993)'s reversal and price momentum effects, they run a regression of this month's supplier return on the 1-month and 1-year lagged customer return. Moreover, Cohen & Frazzini (2008) include lagged returns of the firms' and customers' industry portfolios in order to control for Moskowitz & Grinblatt (1999)'s

and Menzly & Ozbas (2006)'s industry and cross industry momentum effects (respectively). They lastly control for Hou (2006)'s industry lead-lag effect (across and within industry), where they sort customers' and suppliers' industry portfolios by size, and include the 3 different sized portfolios as controls in the regression. They also utilize size and book-to-market controls. The Cohen & Frazzini (2008) findings however, show that even after controlling for all effects that are known to have predictive power, past customer returns still forecast the successive supplier returns.

2.1.3 Variation in Inattention

Cohen & Frazzini (2008) argue that the customer momentum originates from investor's inability to extract information about the economic links between customers and suppliers. If the momentum does come from investor inattention, then varying this inattention should have significant effects on the result. They use data on mutual funds holdings extracted from CDA/spectrum database[3] to proxy inattention. They argue that mutual funds who commonly hold both the supplier and the customer stocks have more incentive to gather information on the respective parts than an otherwise "single" holder of the supplier or customer stock. Cohen & Frazzini (2008) run two separate customer momentum strategies, one for a portfolio that has a high fraction of COMOWN((# of mutual funds holding both the customer and supplier) ÷ (# of mutual funds holding the supplier over the same month)), and another portfolio with a low fraction of COMOWN. They find that the portfolio with low COMOWN (high inattention) yields an abnormal monthly return of 2.7%, whereas its higher counterpart yields a 0.61% a month. Cohen & Frazzini (2008) also provide evidence that common managers trade significantly more of supplier stock when news about a customer is released into the market. This coupled with the high abnormal return for the low COMOWN portfolio strongly supports the hypothesis that the customer momentum results are driven by investor inattention.

[3] *CDA/Spectrum is now called Thomson-Reuters Mutual Funds database*

2.2 Related Research on Economic Links and Predictable Returns

Menzly & Ozbas (2006) use Bureau of Economic Analysis (BEA) input-output surveys to determine industry links, and find significant return predictability amongst *industries* that are related to each other through the supply chain. They find that a trading strategy involving buying (selling) industries whose upstream (supplier) industry had the highest (lowest) returns, yields an annual abnormal return of 7%. Using related downstream (customer) industries instead of upstream yields an annual abnormal return of 6% (Menzly & Ozbas, 2006). Hong, Tourus & Valkanov (2007) find evidence that returns of certain industry portfolios (retail, services, commercial real estate, metal and petroleum) can forecast the US stock market by up to 2 months. The same is true for the eight largest stock markets outside US. They argue that the predictability stems from investor's slow reaction to value relevant information in industry returns that can significantly affect the stock market (Hong, Torous, & Valkanov, 2007). Shahrur, Becker & Rosenfeld (2010) also use the 'Input-Output Benchmark Survey' of the BEA to determine industry links, and find that a customer-supplier/lead-lag effect also exists in international markets.

Less research has been performed on customer-supplier links with individual firms, this probably due to the tediousness of extracting the individual customer-supplier links and merging them with the CRSP database. Funke et al (2010) extend Cohen & Frazzini (2008)'s method of finding return-predictability amongst economically linked firms. Where Cohen & Frazzini (2008) look at monthly returns, Funke et al (2010) study the effects of extreme one-day returns, events that should definitely grab investor attention. They conclude that attention is only 'partially limited', as the customer momentum mainly occurs within the first week after the event, doesn't apply to the largest suppliers and has disappeared (at least for negative events) in the more recent past (Funke et al, 2010). This actually make the Cohen & Frazzini (2008) result seem even stronger, as Funke et al (2010) study the a more obvious form of investor attention (extreme one day returns vs monthly high returns).

Findings by Cohen & Frazzini (2008), Funke et al (2010), Menzly & Ozbas(2006), Hong, Tourus & Valkanov (2007) and Shahrur, Becker & Rosenfeld (2010) all provide evidence of firm/industry level lead-lag effects stemming from customer-supplier relationships. Moreover, Kulak & Schmidt (2011) find further evidence of lead-lag effects (customer-

supplier) and return predictability within the same firm. They suggest that the return predictability doesn't come from investor's lack of understanding of firm/industry related information, rather from investor's lack of understanding of the economic links in general (Kulak & Schmidt, 2011).

2.3 Efficient Market Hypothesis

The anomaly found by Cohen & Frazzini (2008) is very difficult to square with the efficient market hypothesis. The EMH suggests that no asset should earn above normal profits without taking above normal risks. Any strategy whose returns are left unexplained after controlling for traditional risk factors could be considered a violation of the efficient market hypothesis. According to Fama (1970), an efficient market is a market in which prices always fully reflect available information.

Fama (1970) separates the EMH into three subsets; strong-, semi-strong- and weak -form efficient. For the strong form EMH to hold, all private information should be incorporated into asset prices. This means that no one, not even insiders should be able to trade on private information and achieve abnormal returns. Semi-strong form efficiency means that all publically available information should be incorporated into prices. This suggests that all information available through financial statements would not allow professional nor unprofessional investors to earn above normal returns. Given that the economic links in Cohen & Frazzini (2008) are fully available in financial reports due to regulation SFAS no. 131, one could argue that the customer momentum portfolio significantly challenges the semi strong form version of EMH. Lastly, the weak form efficiency requires that all past prices should be incorporated into asset prices. This would suggest that strategies involving price -and earnings momentum should not yield excess returns.

There is a lot of documented evidence suggesting violations of the EMH. Ang, Goetzmann & Schaefer (2010) however argue that a number of studies fail to consider market frictions (transaction costs, short selling constraints etc) when proposing anomalies and EMH empirical tests. They also argue that the papers fail to represent the behaviour of real investors profiting from real trading strategies, as they cannot prove that these investors actually profited from such market inefficiencies. In fact, many of the discovered anomalies

seem to disappear once an article is published in a financial journal. This would suggest that the market is at least somewhat efficient.

2.4 Asset Pricing Tests and Factor Variables

2.4.1 Capital Asset Pricing Model

A central discussion in finance has been to find risk factors that can explain excess returns. First developed by Treynor (1962), Sharpe (1964), Lintner (1965) and Mossin (1966), the Capital Asset Pricing model was created with a purpose of using a market risk factor in order to predict and explain stock returns. Given that all other risks could be diversified away, the only risk factor necessary to explain asset returns was market risk. It was later suggested that the market model, and the corresponding market portfolio was insufficient, and that holding other combinations of assets in "non-market portfolios" result in higher reward-to-risk ratios than the market portfolio (Ang, Goetzmann, Schaefer, 2010). The model also failed to explain several anomalies that were found in the market. Amongst these were the size effect (Banz, 1981), the book-to-market effect (Stattman, 1980) and the momentum effect (Jagadeesh & Titman, 1993). Multifactor models that build on CAPM have therefore been created in order to better explain asset returns in the market.

2.4.2 Fama & French (1993) 3-Factor Model

Fama & French (1993) find that the cross-section of average returns of common stock show little relation to the CAPM beta. They however find that characteristics and financial ratios help explain cross-section of asset returns. They propose a model that includes portfolios formed on size (SMB: Small minus Big) and book-to-market (HML: High minus Low) in addition to the market portfolio in CAPM:

$$R_i(t) - RF(t) = a_i + b_i[RM(t) - RF(t)] + s_i SMB(t) + h_i HML(t) + e_i(t)$$

where $R_i(t)$ is the return on asset i for month t, $RF(t)$ is the risk-free rate, $RM(t)$ is the market return, $SMB(t)$ is the difference between the returns on diversified portfolios of small stocks and big stocks, and $HML(t)$ is the difference between the returns on diversified portfolios of high book-to-market stocks and low book-to-market stocks (Fama & French, 2012). Fama & French (1993) run several regressions on the portfolios that they examine and find that the intercepts equal 0 after controlling for excess market return, size and B/M.

2.4.3 Carhart (1997) 4-factor Model

Carhart (1997) finds significant evidence for momentum in stock returns, in which they are unable to explain using the 3-factor model. Using Fama & French (1993) 3-factor model, plus an additional factor that captures the momentum effect of Jagadeesh & Titman (1993), yields the Carhart (1997) 4-factor model:

$$R_i(t) - RF(t) = a_i + b_i[RM(t) - RF(t)] + s_i SMB(t) + h_i HML(t) + p_i PR1YR(t) + e_i(t)$$

where $PR1YR(t)$ is the difference between the month *t* returns on diversified portfolios of the winners and losers of the past year. Carhart (1997) finds that the 4-factor model can explain considerable amount of variation in stock returns and that it significantly improves on the average pricing errors found with CAPM and 3-factor Model.

2.4.4 Pastor & Stambaugh (2003) 4-factor Model

Pastor & Stambaugh (2003) find that market-wide liquidity is priced into assets. They find that stocks that are more sensitive to aggregate liquidity, experience higher expected returns even after controlling for size, value and momentum. The Pastor & Stambaugh (2003) model is an augmented version of Fama & French (1993) 3-factor model with an additional liquidity factor:

$$R_i(t) - RF(t) = a_i + b_i[RM(t) - RF(t)] + s_i SMB(t) + h_i HML(t) + +l_i LIQ(t) + e_i(t)$$

where $l_i LIQ(t)$ is the difference between the month *t* returns on portfolios formed on stocks with high predicted sensitivities to liquidity and stocks with low predicted sensitivities to liquidity. Not only did Pastor & Stambaugh (2003) find that expected returns are cross-sectionally related to fluctuations in liquidity, but also found that the liquidity factor captured half of the profits in their momentum strategy. This is consistent with the findings of Grinblatt & Moskowitz (2004), who find momentum to be strongest in small-cap and illiquid stocks.

2.4.5 Selected Research on Other Asset Pricing Factors

Leverage

Modigliani & Miller (1958) present in their proposition II, that firm leverage has a positive effect on returns due to the increased risk for equity holders. Building on this, Muradoglu & Sivaprasad (2010) provide evidence that a leverage factor captures firms' sensitivities to risk. Their leverage factor, HLMLL (high leverage minus low leverage) is added to Carhart (1997) 4-factor model, and conclude that their 5-factor model best explains variation in asset returns. Using a sample of UK firms from 1980-2008, they find that low-leveraged stocks are negatively related to asset returns, whereas high leveraged stocks to be positively related to asset returns (Muradoglu & Sivaprasad, 2010). Other research also suggest, in contradiction to MM.II, that leverage is negatively related to returns (Penman, Richardson and Tuna, 2007 and George and Hwang, 2010). George & Hwang (2010) suggest that if the cost of financial distress is expensive, then high (low) leveraged firms tend to be less (more) sensitive to systematic distress risk. They argue that distress costs heighten exposure to systematic risk, and suggest that firms with high distress costs choose low leverage, which causes this negative correlation (George & Hwang, 2010).

Operating Leverage

Novy-Marx (2011) links operating leverage to asset returns. He finds operating leverage to predict cross-sectional returns, and finds that portfolios formed by sorting on operating leverage generate abnormal excess returns. Novy-Marx (2011) shows that firms with high operating leverage earn significantly higher average returns than firms with low operating leverage. He argues that production cost could leave a firm's assets with just as much exposure to economic risks as debt service (leverage). In this way, operating leverage could be considered a significant risk factor in asset pricing.

Industries

An interesting topic in asset pricing is also whether industries play a role in explaining asset returns. Chou, Ho & Ko (2012) find significant evidence that asset pricing models fail to explain variation in industry returns. Specifically, they find that asset pricing anomalies, including the small-firm effect, the BM effect, and the momentum effect, all relate to industry classifications.

Investment

Cooper, Gulen & Schill (2009) document a strong negative relationship between growth in

assets and stock returns. Specifically, they find a yearly return spread between low -and high investment stocks of 20%. Moreover, they find asset growth rate to predict asset returns in both small –and large cap stocks. They argue that the premium is too large to be able to console with traditional risk-based explanations. Aharoni, Grundy & Zeng (2012) also find evidence of investment being a central predictor of asset returns. Specifically, they find evidence suggesting that returns and expected investment at the firm level is negatively related. By firm level investment they mean asset growth rather than per-share growth (Aharoni, Grundy & Zeng, 2012). Fama & French (2014) find a similar result by investigating both growth of assets and growth of book equity, but find portfolios sorted on growth of assets produce a larger spread in average returns than using book equity.

Profitability

Recent studies have shown a significant relationship between profitability and asset prices. Novy-Marx (2013) finds profitable firms to generate significantly higher returns than non-profitable firms. He generates positive abnormal excess returns by performing a trading strategy that involves purchasing (shorting) stocks that have high (low) gross-profitability between 1963 and 2010 (Novy-Marx, 2013). These findings are also confirmed by Fama & French (2014) who find operating profitability[4] to be correlated with asset returns. Moreover, Hou, Xue & Zhang (2012) form portfolios based on return on equity, and find that high profitability stocks is associated with higher return (where the reverse is also true). This view is supported by Wang & Yu (2013) who find a monthly profitability premium using ROE of 0.98%. They find that risk only plays a moderate role in the profitability premium, but find strong evidence for the investor attention channel of Hong & Stein (1999). Specifically, they find that investors underreact to news about profitability, causing high (low) profitability firms to be underpriced (overpriced) (Wang & Yu, 2013).

Profitability is quite a puzzling issue. According to EMH, no one should gain any additional return without taking additional risk. For the other factors mentioned above, risk can at least partly explain the why there is an asset premium. The problem with profitability however, is that there is no clear relationship between risk and profitability. Profitable firms have a tendency to be of higher quality and have better competitive advantages than non-profitable

[4] Operating profitability is calculated by Fama & French (2014) as (EBIT-Interests Expenses)/Book Equity. Further analysis of operating profitability will be conducted without interest expenses.

firms, and should therefore not compensate you for any additional risk-taking (Bryan, 2013).

2.4.6 Fama & French (2014) 5-Factor Model

Several research papers have been conducted on whether the classic asset pricing models such as F&F 3-Factor and Carhart 4-factor, are good enough in explaining asset returns. Motivated by Novy-Marx (2013)'s findings of profitability premium and Aharoni, Grundy & Zeng (2012)'s asset growth premium, Fama & French (2014) present a five-factor model that includes two additional variables that captures the profitability -and investment effect.

$$R_i(t) - RF(t) = a_i + b_i[RM(t) - RF(t)] + s_i SMB(t) + h_i HML(t) + r_i RMW(t) + c_i CMA(t)$$

where $r_i RMW(t)$ is the difference between the returns on diversified portfolios of stocks with robust and weak profitability, and $c_i CMA(t)$ is the difference between the returns on diversified portfolios of low(conservative) and high(aggressive) investment stocks. Fama & French (2014) find significant evidence that profitability and asset growth is correlated to asset returns. The model is useful in describing asset returns in applied cases, however is rejected in all GRS[5] tests. This has implications for asset pricing, as the model doesn't fully reflect variation in asset returns. The model is however acceptable at explaining variation in portfolios formed on size and a couple of portfolios formed on B/M, Operating profitability and investment (Fama & French, 2014).

Another interesting finding in their paper, is that their factor loading HML is actually found redundant, as its high average return is fully captured by its exposures to the other variables (Fama & French, 2014). Specifically, they find that the value premium is mostly absorbed by the investment and profitability factors. Fama & French (2014) therefore find that a four-factor model that excludes HML performs just as well as the five-factor model. A five-factor model is however useful if one wants to evaluate whether a portfolio return is related to investment, value -and profitability premiums.

[5] GRS statisic of Gibbons, Ross and Shanken (1989) tests the efficiency of portfolios.

2.5 Selected Research on Limited attention & Information Diffusion

Traditional asset pricing is based on the notion that the market is efficient. Any new information should immediately be processed in the market and subsequently be incorporated into prices. Selected research in psychology and finance however, suggests that investors are slow at processing information, creating delays in stock price reactions. With the vast amount of information available in the market, investors need to be selective with how they process this information. Kahneman (1973) finds that in order for people to allocate their attention towards a specific task, it would require them to reduce their attention from other tasks. In this way, attention is a scarce cognitive resource (Kahneman, 1973).

2.5.1 Theoretical Research

Theoretical frameworks emerged as a result of discussions on investor's informational capacity constraints. Merton (1987) was one of the first to create a model that incorporates investor inattention and incomplete information. The key behavioural assumption in his capital market equilibrium model is that an investor will only add a security to his portfolio if he knows about that specific security. When some stocks gets neglected by the market, he suggests that a small subset of investors will try to take advantage of this, and hence take large undiversified positions in those neglected stocks. As a reward for the increased risk, investors will earn high subsequent expected returns (Merton, 1987).

Hong & Stein (1999) employ a gradual information diffusion model that unifies both underreaction and overreaction by looking at the interaction between two types of market participants, namely news-watchers and momentum traders. First, they assume that private information diffuses slowly across the news-watchers population, causing underreaction. A second group of traders will try to exploit this and create excessive momentum in stock returns, which eventually culminates into overreaction (Hong & Stein, 1999). In this way, they suggest that both overreaction and underreaction stems from gradual diffusion of information.

Hirshleifer & Teoh (2003) analyze how a change in accounting disclosure policies affect asset prices in the presence of limited attention and where investors have informational processing constraints. They argue that investors can have very different perceptions on informational equivalent accounting disclosures if they change the presentation of the

disclosures (Hirshleifer & Teoh, 2003). For instance, investors might perceive information disclosed in the income statement as more important than if it was listed as additional item in footnotes, even though they contain the same information.

2.5.2 Empirical Research

Investor Attention & Information Diffusion

There is a vast amount of empirical literature and evidence on slow diffusion of information and investor inattention. Huberman & Regev (2001) study the effect of re-releasing information in the market that has previously been published. They specifically study the stock price reaction of ENMD (a biotech firm) after releasing a negative piece of information in the New York Times that has previously been reported in 'Nature' (a scientific journal) five months earlier. The stock price soared on the re-releasing in the Times, even though the information was not at all new.

Barber & Odean (2008) find that individual investors display attention driven buying behaviour, and find they are net buyers on high volume days, and when stocks are in the news. Da, Engelberg and Gao (2011) measure investor attention using search frequency in Google, and find that an increase in this frequency can predict stock prices in the following two weeks. Hirshleifer et al (2004) study the effect of net operating assets (NOA) on future stock returns, and find the relationship between NOA and future returns to be negatively related. They suggest that an increase in NOA[6] could raise doubts about future profitability, as the firm accumulates accounting earnings without accumulating free cash flow. As investors tend to react positively (negatively) to increases (decreases) in NOA, when the long run sustainability of performance could suggest otherwise, Hirshleifer et al (2004) argue that limited attention causes investors to misperceive information contained in NOA.

Several studies have shown that investors fail to consider valuable information from related firms. Ramnath (2002) finds that investors don't fully incorporate information retrieved from an industry's first earnings announcements to the subsequent announcements of related firms. As a result, this underreaction will generate return predictability for the following announcers. Moreover, Kovacs (2009) suggests that underreaction to industry specific

[6] Where Net Operating Assets (NOA) = Operating Earnings – Free Cash Flow

information contributes to the post earnings announcement drift. Specifically, earnings-announcements from peer firms that arrive after the firm's own earnings-announcement strongly influence a firm's post earnings announcement drift, as the information from peers contain value relevant industry information. The effect however is only present when the peer earnings surprises confirm the firm's initial earnings surprise, and in industries that exhibit contagion type intra-industry info transfers. Hou (2007) finds that within an industry, big firms lead small firms, and that this lead-lag effect stems from information diffusion. Specifically, smaller stocks react slowly to industry relevant information from larger firms. The effect however seems to be more pronounced in less competitive –and concentrated industries, and to largely originate from the slow response of small firms to negative news of larger firms.

Dellavigna & Pollet (2009) and Hirshleifer, Lim & Teoh (2009) study the reduced stock price reaction of earnings announcements on days that investors are assumed to be inattentive. Dellavigna & Pollet (2009) find that earnings announcements reactions of Fridays are significantly smaller than on other weekdays. Moreover, Hirshleifer, Lim & Teoh (2009) find weaker reactions to a firm's earnings announcements, when other firms make a number of same day earnings announcements.

Two common anomalies that are difficult to explain by traditional asset pricing models and that are often linked to limited attention are the post earnings announcement drift (earnings-momentum) and momentum in asset returns. Bernard & Thomas (1989) was one of the first to link earnings momentum to information diffusion and investor attention. Of more recent research is Hou, Peng & Xiong (2009), who examine investor attention with respect to both earnings –and price momentum. They find that investors tend to underreact to earnings announcements, causing earnings momentum. Moreover, due to behavioural biases (overconfidence and extrapolative expectations), they find that investors generate price overreaction, which in return could explain price momentum in stock returns. Hong, Lim & Stein (1999) find momentum to be more pronounced amongst small stocks and stocks with less analyst coverage.

3. Data

In order to examine the fundamental differences between customers and suppliers, I have to have a file that actually links the customers with the suppliers. The file utilized in this paper was provided by Jarrad Harford, who is currently working on a paper with Schonlau and Stainfield about the value impact of economic links in relation to M&A activity. The file includes information about customer/supplier links from 1990-2009. Harford, Schonlau and Stainfield (2013) extracted information about suppliers' respective customers through the Compustat database. Information however, is limited to the largest customers, as firms are only required to report the identity of customers responsible more than 10% of overall sales, profits or losses (Harford, Schonlau & Stainfield, 2013). Some of the customer names reported in Compustat appear only in an abbreviated form, and they utilize a code-based matching algorithm to identify the correct customer (Harford, Schonlau & Stainfield, 2013). With a complete list of customer and supplier gvkeys and their links, I proceed by extracting yearly accounting information on customers and suppliers from January 1990 to December 2009 from the CRSP/Compustat merged database (CCM) and import it into Stata. The CCM file contains all firms (inactive or active) listed on NYSE, Amex, and Nasdaq.

Some observations in the 'Links'[7] dataset have missing customer gvkeys, and in order to be able to study unique customer-supplier relationships, the supplier firms with missing customer information are dropped from the dataset. Following this I prepare the 'Fundamentals' dataset to make it ready for being merged with the information about customer/supplier links. Checking for duplicates in 'Fundamentals', I find several observations to be repeated twice[8], and therefore drop all observations whose *gvkey* and *fyear* are duplicates. I proceed by performing two 1:m merges in Stata using 'Fundamentals' dataset as the master set, and *supplier* (*customer) gvkey* and f*year* as key variables to be identified. The 'Links' dataset is then the 'using' data set for these merges. For the first merge I use 'Fundamentals' dataset and supplier information. I delete all observations whose match is not successful (both those in the using dataset (code 2) and the master dataset (code

[7] The original dataset from Jarrad Harford, now referred to as 'Links', and the CCM datatset referred to as 'Fundamentals'

[8] Due to change of reporting dates in Compustat

1)). I further create a dummy variable named *supplier*, which is equal to 1 if the firm is listed as a supplier firm and 0 otherwise. After dropping all matches not coded (3), all observations will contain a supplier dummy variable equal to 1.

The second merge is also performed using 'Fundamentals' dataset, but using customer information. I delete all observations that are from the using dataset only (code (2)), but keep the observations from the master data. Similarly to the first merge, I create a dummy variable equal to 1 if the firm is listed as a customer in the dataset.

Following the merges, I append the two merged Stata files. In order for the append to be successful, I make sure that the names of the variables that have the same definitions in the two datasets, are labelled identically (i.e. *crsp_cust_name* and *crsp_supplier_name* to *crsp_name*). The dataset now contains information on whether they are listed as customers and/or suppliers and their respective information about fundamentals.

In the situation where the firm is listed as a customer and a supplier, there will be two observations containing the same information about fundamentals, but differ with respect to information contained in certain variables such as *Supplier* and *Customer*. Where one observation comes from the first merge and has a *Supplier* value equal to 1, the other comes from the second merge and has a *Customer* value equal to 1, i.e:

Table 1.

Gvkey	**Fyear**	**Conm**	**Supplier**	**Customer**	**Cust_Gvkey**
1446	1992	American Exploration Co	1	0	.
1446	1992	American Exploration Co	0	1	6127

In order for the observations to be copied into one line, I utilize a code[9] that copies information from one "duplicate" to the other, causing the two lines to be perfect duplicates:

Table 2.

Gvkey	**Fyear**	**Conm**	**Supplier**	**Customer**	**Cust_Gvkey**
1446	1992	American Exploration Co	1	1	6127

[9] bysort gvkey fyear : *replace Variable = Variable[3 - _n] if missing(Variable) & _N == 2.*

1446	1992	American Exploration Co	1	1	6127

After combining the information from the two lines, I proceed by dropping all perfect duplicates, so that there is only one observation for each *gvkey* and *fyear*, which includes dummy variables stating whether the firm is a customer, a supplier or both. Moreover, since the unidentified firms do not provide any useful information for the analysis, I delete all observations where the firms are neither listed as a customer nor a supplier.

In order to explore differences in industries, I download details on Kenneth French's 12 industry factors[10], and create 12 dummy variables based on SIC codes. The supplier and customer firms are then assigned to one of 12 industries based on its 4-digit SIC code extracted from CCM.

The final dataset now contains accounting information from 1990-2009, details on whether firms are listed as customers and/or suppliers, and information about industries.

[10] Dowloaded from Kenneth French Website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_12_ind_port.html , For details see Appendix Table A.1.

4. Fundamental Information and Key Statistics

4.1 Comparing Customers & Suppliers along a Set of Variables

With accounting information linked to the firm gvkey's and dummy variables suggesting whether the firm is a supplier or a customer, I calculate several key variables known to be related to empirical asset pricing. The variables I consider are size, B/M (with and without goodwill), profitability ratios (ROA, ROE, Gross Profitability and Operating Profitability), leverage ratio and operating leverage.

Table 3. Definitions

Size	Log(Size)
B/M	(Total Assets – Intangibles - Current Liabilities- Long Term Debt) / Market Value
B/M1	(Total Assets – Intangibles – Goodwill - Current Liabilities - Long term debt) / Market Value
ROA	Net Income / Total Assets
ROE	Net Income / Book Value of Equity
Gross Profitability	(Sales - COGS) / Total Assets
Operating Profitability (using Total Assets) [11]	(Sales – COGS - SG&A) / Total Assets
Operating Profitability (using Book Equity)	(Sales - COGS- SG&A) / Book Value of Equity
Operating Leverage	SG&A / Total Assets
Leverage Ratio	(Current Liabilities + Long Term Debt) / Total Assets

I do the above steps in order to observe whether customers and suppliers differ fundamentally. The variables above are all found to be related to asset returns, and they are useful in order to see whether a systematic difference between customers and suppliers could be related to asset pricing. The output shows some interesting results, especially with respect to profitability.

[11] Use operating profitability as suggested by Fama & French (2014), yet without interest expenses (too many values missing from CRSP/Compustat).

Table 4. Averages of Firm Key Statistics (Averages of Each Group Individually)

	Supplier firms	*Customer Firms*	*All Firms*
Size	**5.000*****	**7.961*****	**5.925*****
	(389.11)	(407.46)	(436.07)
N	23781	12428	33702
BM	**1.043*****	**1.247*****	**1.119*****
	(15.79)	(23.04)	(22.18)
N	23589	12338	33687
BM1	**0.915*****	**1.128*****	**0.994*****
	(13.88)	(20.54)	(19.68)
N	23589	12338	33432
Gross Profitability	**0.322*****	**0.348*****	**0.332*****
	(144.96)	(141.27)	(186.53)
N	23770	12423	33687
Op. Profitability (Total Assets)	**0.0470*****	**0.126*****	**0.0704*****
	(17.62)	(88.63)	(35.46)
N	20835	10279	28876
Op. Profitability (Book Equity)	**0.0799*****	**0.173*****	**0.108*****
	(4.70)	(11.60)	(8.16)
N	20772	10237	28776
ROA	**-0.0828*****	**0.0162*****	**-0.0517*****
	(-20.15)	(9.38)	(-17.50)
N	23769	12424	33687
ROE	**-0.139*****	**-0.00228*****	**-0.0969*****
	(-3.70)	(-0.10)	(-3.48)
N	23697	12365	33562
Leverage Ratio	**0.217*****	**0.253*****	**0.228*****
	(130.61)	(140.03)	(173.50)
N	23709	12369	33577

Op. Leverage	**0.333*****	**0.278*****	**0.320*****
	(112.66)	(120.30)	(141.55)
N	20835	10279	28876

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table shows that the average profitability measures (ROA, ROE, Op.Profitability) and size is significantly different from customers to suppliers, so an interesting thing to check is whether this difference stays constant throughout time. Using ROA, operating profitability and size, I generate a table of means and medians from 1990 to 2009:

Table 5. ROA, Operating Proftiability & Size Over Time

	ROA				Operating Profitability				Size			
	Supplier		Customer		Supplier		Customer		Supplier		Customer	
fyear	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
1990	-0.0588	0.0332	0.0213	0.0439	0.0277	0.0970	0.1320	0.1346	3.3036	3.3613	6.7593	6.7503
1991	-0.0366	0.0224	0.0283	0.0320	0.0737	0.1061	0.1374	0.1348	4.1560	3.9118	7.3750	7.5239
1992	-0.0390	0.0306	0.0231	0.0357	0.0696	0.1173	0.1437	0.1392	4.2440	4.0159	7.2199	7.3757
1993	-0.0472	0.0293	0.0178	0.0353	0.0739	0.1145	0.1305	0.1323	4.2976	4.0469	7.1926	7.3285
1994	-0.0523	0.0374	0.0366	0.0453	0.0750	0.1195	0.1425	0.1468	4.3630	4.1308	7.2032	7.3206
1995	-0.0334	0.0337	0.0286	0.0414	0.0868	0.1177	0.1423	0.1466	4.4618	4.2501	7.3321	7.3298
1996	-0.0834	0.0319	0.0289	0.0447	0.0511	0.1164	0.1292	0.1376	4.5419	4.2960	7.3826	7.3871
1997	-0.0950	0.0279	0.0122	0.0404	0.0383	0.1183	0.1235	0.1403	4.6036	4.4075	7.5800	7.5846
1998	-0.1015	0.0136	0.0106	0.0326	0.0354	0.1035	0.1202	0.1310	4.7215	4.5150	7.6410	7.6228
1999	-0.0749	0.0168	0.0150	0.0401	0.0274	0.0875	0.1112	0.1351	4.9602	4.7563	7.8612	7.9338
2000	-0.1419	0.0098	-0.0132	0.0352	0.0151	0.0946	0.1018	0.1274	5.2053	5.0443	8.0071	8.0263
2001	-0.2114	-0.0206	-0.0517	0.0206	-0.0259	0.0659	0.0943	0.1137	5.2038	5.0460	8.1014	8.1230
2002	-0.1818	-0.0063	-0.0208	0.0261	-0.0003	0.0781	0.1098	0.1189	5.2978	5.2154	8.3436	8.4055
2003	-0.0888	0.0176	0.0213	0.0368	0.0352	0.0848	0.1234	0.1240	5.4260	5.3294	8.4988	8.5577
2004	-0.0457	0.0300	0.0329	0.0464	0.0586	0.0954	0.1346	0.1307	5.5520	5.4113	8.5802	8.6376
2005	-0.0329	0.0323	0.0429	0.0505	0.0665	0.1004	0.1367	0.1367	5.7024	5.5404	8.6369	8.6479
2006	-0.0601	0.0329	0.0383	0.0532	0.0572	0.0982	0.1343	0.1334	5.8363	5.7570	8.6714	8.7102
2007	-0.0522	0.0275	0.0410	0.0509	0.0492	0.0970	0.1325	0.1363	5.9337	5.8559	8.8655	8.8671
2008	-0.1249	0.0138	-0.0009	0.0413	0.0457	0.1029	0.1318	0.1360	6.0247	5.9443	8.9495	8.9131
2009	-0.0755	0.0102	0.0189	0.0325	0.0577	0.0890	0.1210	0.1215	6.1225	6.0336	9.2332	9.2482
Total	-0.0828	0.0229	0.0162	0.0395	0.0470	0.1020	0.1264	0.1333	4.9997	4.8150	7.9619	8.0362

The table above shows that the difference in ROA, operating profitability and size between customers and suppliers stays more or less constant throughout time. The larger average size

of the customer relative to the supplier does however make economic sense, and can be partly explained by the data generating process. A supplier firm is only required to report the identity of customers representing more than 10% of annual sales. Given that the customer needs to represent a big chunk of annual sales, it is more likely to identify a firm of a larger size than otherwise (Cohen & Frazzini, 2008). The difference in profitability however is more of a puzzling issue. Profitability shouldn't (on average) differ much from whether the firm is a customer or supplier. Given this, I want to discuss two possible explanations to the differences in profitability, namely industries and size.

4.2 Industries as a Factor Explaining Profitability

Table 5 shows that the difference in profitability stays more or less constant over time. It is also well known that one should be careful in comparing profitability measures across different industries. Some industries may be more asset-intensive, requiring them to have large storage houses and a large portfolio of machinery. As an example, the energy sector (below listed as Enrgy) would require a lot of assets, whereas telecom (Telecm) might require less. It is therefore interesting to see whether customers and suppliers tend to operate in different industries. If customers are highly concentrated in one industry, whereas suppliers are concentrated in another, this could in return, explain the difference in profitability between customers and suppliers.

Figure 1. Fraction of Same Industry Customer/Supplier Links for Different Industries

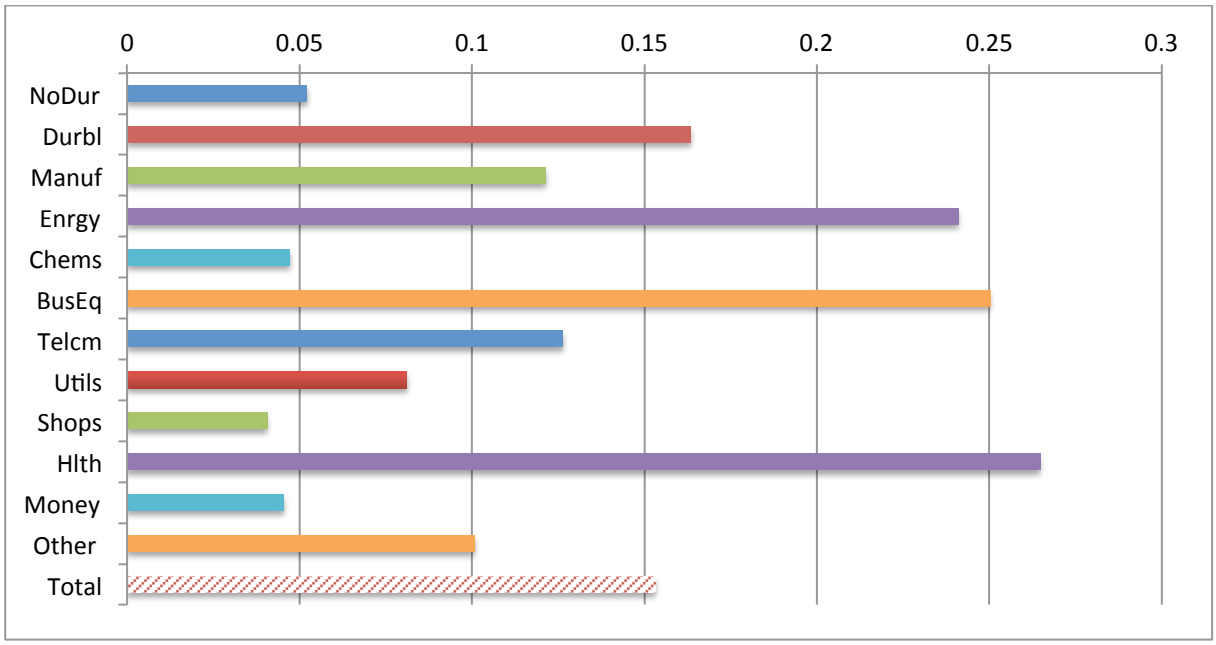
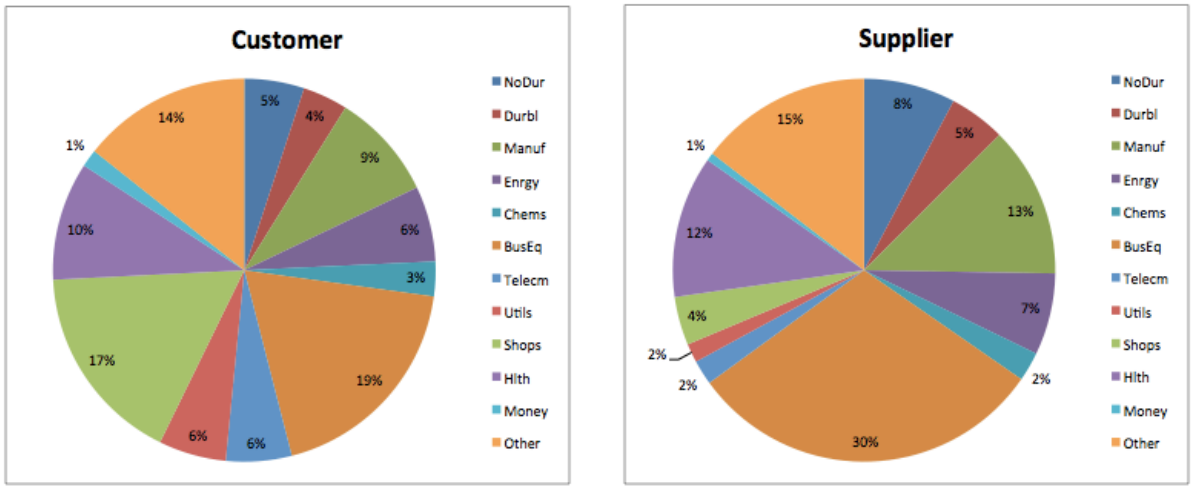


Figure 1 demonstrates whether linked customers and suppliers operate within the same industry. As we can see, only a small fraction of customer/supplier relationships are within industry. The above figure displays the unique customer/supplier relationships, and as a result will contain cases where a firm is listed as a customer to several suppliers. I therefore wish to visualize how customers and suppliers differ with respect to industry concentration in general, irrespective of whether they are linked or not.

Figure 2. Fraction of Number of Observations in Each Industry[12]



As seen in Figure 2, there is a moderate difference between customers and suppliers with respect to industry concentration. First, there are cases where customers & suppliers are very similar, i.e Energy, Chemicals, Money, Health[13]. There are other cases however, where they are very different. Where almost 30% of the customer observations stems from shops, utilities and telecom, the same industries only stand for about 8% in supplier firms. Moreover, 43% of the supplier firms are concentrated in manufacturing and business equipment. The same industries only represent about 28% of the customer observations. ROA and Operating Profitability however, even differ significantly within industries. Take the Business Equipment sector as an example. This industry represents 30% of all supplier

[12] Ken French 12 Industry Portfolios. NoDur: Consumer NonDurables -- Food, Tobacco, Textiles, Apparel, Leather, Toys. Durbl: Consumer Durables -- Cars, TV's, Furniture, Household Appliances. Manuf: Manufacturing -- Machinery, Trucks, Planes, Off Furn, Paper, Com Printing. Enrgy: Oil, Gas, and Coal Extraction and Products. Chems: Chemicals and Allied Products. BusEq: Business Equipment -- Computers, Software, and Electronic Equipment. Telcm: Telephone and Television Transmission. Utils: Utilities. Shops: Wholesale, Retail, and Some Services (Laundries, Repair Shops). Hlth: Healthcare, Medical Equipment, and Drugs. Money: Finance. Other: Other -- Mines, Constr, BldMt, Trans, Hotels, Bus Serv, Entertainment

[13] Some of the colours in Figure 2 are difficult to seperate. The list starts with NoDur, and will move clock-wise from there.

observations and 19% of all customer firms. Both the average ROA and operating profitability however, differs significantly from whether it is a supplier or a customer firm:

Table 6. *Profitability for Business Equipment Industry*

	Supplier firms	*Customer Firms*	*All firms*
ROA	**-0.139*** **	**-0.0257*** **	**-0.117*** **
	(-16.29)	(-3.89)	(-16.25)
N	7235	2379	8786
Op. Profitability	**0.000401**	**0.100*** **	**0.0189*** **
	(0.08)	(26.15)	(4.49)
N	6969	2310	8462

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

As one can see above, there is an 11.3% (10%) difference in ROA (Op. Profitability) between customer –and supplier firms in the Business Equipment industry. This however, is not at all unique. Health (represents healthcare, medical equipment, and drugs) stands for 10% of customer observations, and 12% of supplier observations. The difference in ROA (Op. Profitability) between customers and suppliers is now 21.6% (11%).

Table 7. Profitability for Health Industry

	Supplier firms	*Customer Firms*	*All firms*
ROA	**-0.219*****	**-0.00323**	**-0.162*****
	(-21.55)	(-0.49)	(-20.34)
N	2859	1264	3828
Op. Profitability	**-0.0315*****	**0.141*****	**0.0231*****
	(-3.91)	(24.08)	(3.74)
N	1845	1007	2610

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table above shows some interesting results. Profitability seems to be very different from supplier -to customer firms, irrespective of whether they are in the same industries. In fact, this is true in all industries but utilities, where ROA is actually very similar between customers and suppliers (see Table A.2 in Appendix). The evidence above suggests that the difference in profitability cannot be explained by industry concentration.

4.3 Size as a Factor Explaining Profitability

An interesting observation is that measures of profitability for customers and suppliers change when you move down the income statement. Table 4 shows that gross profitability is only moderately different from customers to suppliers, while there is a large difference for operating profitability, ROA and ROE. I therefore want to propose a suggestion that the difference in profitability between customers and suppliers actually contain a size effect. As we already know from Table 4 the average size of the customer is much larger than the average size of the supplier. Looking more closely at operating profitability given all firms, supplier firms, and customers firms across different averages, one can see that larger firms do outperform smaller firms in terms of profitability.

Table 8. Average Operating Profitability Given Size and Group

	Operating Profitability					
	All Firms		***Supplier***		***Customer***	
	Above or below Average Size		*Above or below Average Size*		*Above or below Average Size*	
	(Size<5.9)	*(Size>5.9)*	*(Size<5.0)*	*(Size>5.0)*	*(Size<7.9)*	*(Size>7.9)*
Op. Profitability	0.0182***	0.1354***	-0.0100*	0.115***	0.112***	0.142***
	(5.27)	(167.05)	(-2.13)	(95.14)	(45.03)	(125.77)
N	16022	12854	11367	9468	5421	4858

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In the table above, I compare operating profitability given the average size of each group, and find that there is some sort of size effect with respect to profitability. While there is less of an effect in the customer group (where the average size is very high), the effect is stronger for 'all firms' and 'supplier firms' groups. In these groups, there is a clear difference in profitability for smaller and larger firms. These findings are consistent with Hou & van Dijik (2010) who find that small firms experience negative shocks to their profitability while big firms experience positive shocks from 1984-2005 (before 1984 it was non-existent). They argue that this is due to the change in industry market structure (trade liberalization & industrial deregulation) in the 80s-90s, and that smaller firms have been especially slow -and found it especially challenging to cope with these structural changes. Moreover, they argue that it could stem from the "new lists" effect by Fama & French (2004), where there was a dramatic increase in newly listed firms in the 80s-90s, whose profitability and survival rate

declined sharply.

Above we saw that operating profitability vary by size. As mentioned earlier, there is a large difference between operating -and gross profitability. Selling, general and administrative expenses (SG&A) is the only value that differs between these two measures. The table below shows that SG&A does represent a larger fraction of total assets in supplier firms than in customer firms:

Table 9. Average Operating Leverage

	Supplier	**Customer**
SG&A/Total Assets	0.333***	0.278***
	(112.66)	(120.30)
N	20835	10279

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The results are similar to Table 4 and suggest that operating leverage is consistently larger for suppliers than for customers. Furthermore, if these operating costs are truly fixed, then results should be even stronger when splitting the sample by size. Looking at the average operating leverage above and below the average size of the three groups, I find support that SG&A is greater for smaller firms than larger firms.

Table 10. Average Operating Leverage Given Size and Group

	Average SG&A/AT					
	All Firms		***Supplier***		***Customer***	
	(Size<5.9)	*(Size>5.9)*	*(Size<5.0)*	*(Size>5.0)*	*(Size<7.9)*	*(Size>7.9)*
SG&A/ Tot. Assets	0.402***	0.217***	0.438***	0.206***	0.344***	0.203***
	(107.30)	(137.74)	(87.64)	(118.48)	(94.89)	(88.27)
N	16022	12854	11367	9468	5417	4862

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This difference in SG&A is consistent with the presence of economies of scale. Larger firms might be able to spread these costs across a larger production volume and across divisions. Even though economies of scale most often refer to production (specialized labour, fixed costs spread over large quantities etc), it might be that larger firms receive discounts on other items nonrelated to production but related to SG&A. Examples of this could be electricity, audit expenses, and office building rents. Moreover, a large firm might experience

economies of scale by having some services in office, i.e legal department. Some of these firms might even be so large due to M&A activity that could have been motivated by economies of scale in itself.

The above discussions display some interesting results. Profitability differs significantly from customers to suppliers. While this difference in profitability cannot explain the customer momentum anomaly directly, it still points to systematic differences between the two groups of firms. In the next two sections, the analysis will focus on profitability in general, irrespective on whether customer firms on average have higher profitability than supplier firms. I will in these sections link profitability to the customer momentum returns of Cohen & Frazzini (2008).

5. Profitability, a Factor Explaining Customer Momentum?

Cohen & Frazzini (2008) find that the correlation between customers and suppliers spans beyond stock returns and moves into real quantities as well. They utilize supplier –and customer (lagged) operating income and sales, and find these figures to be much more correlated in periods where customers and suppliers are linked (customer represents more than 10% of sales) versus not linked. They find that the correlation of customer to supplier operating income increases by 38.7% -and the correlation of customer to supplier sales increases by 51.4%, when they are linked (Cohen & Frazzini, 2008).

We know that there is correlation between customers and suppliers in terms of revenues and operating income. If one holds total assets constant, it is also likely that customers and suppliers are correlated in terms of profitability. I will in the next two sections perform two analyses that tests whether customers and suppliers are related in terms of profitability.

5.1 Correlation between customer –and supplier profitability

In order to check whether customers and suppliers are correlated in terms of profitability, I take a random sample of 60 customer/supplier relationships that have non-missing profitability measures of at least 5 consecutive years. For each customer/supplier relationship, I calculate the correlation between customer profitability (both operating and gross profitability) at time *(t)* and supplier profitability at time (*t)* and (*t+1).* The additional inclusion of (*t+1)* is related to the fact that the reaction of supplier profitability to customer profitability might not occur instantaneously. I proceed by calculating the average correlation of the 60 relationships and get the following output:

Table 11. Correlation between Customer -and Supplier Gross Profitability

	Supplier Gross Profitability at Time (***t)***	Supplier Gross Profitability at Time (***t+1)***
Customer Gross Profitability at Time (***t)***	0.17261575	0.089837129
N	60	60

Table 12. Correlation between Customer -and Supplier Operating Profitability

	Supplier Op. Profitability at Time (***t***)	Supplier Op. Profitability at Time (***t+1***)
Customer Op. Profitability at Time (***t***)	0.220348531	0.053754925
N	60	60

All of the cases show a slight positive correlation, however the above table also displays some very interesting results. First, in both cases, the correlation is significantly reduced when using lags. This is in contradiction to my predictions, as one wouldn't expect customer profitability to have an instantaneous effect on supplier profitability. The result could indicate that the reaction to supplier profitability happens faster, i.e after 3 or 6 months. Second, the correlation is stronger for operating profitability than gross profitability. This is also a bit surprising, as one would expect there to be a stronger relationship between customers and suppliers with respect to gross profitability. For instance, an increase in SG&A in customer firm shouldn't necessarily influence the SG&A expenses in the supplier firm. It could be however, that customer *operating* profitability at time (*t)* might affect supplier *gross* profitability at time (*t+1)*. In fact, the correlation is actually the highest when comparing the other cases with supplier profitability at (*t+1).*

Table 13. Correlation Between Customer Op. Profitability at Time (t) with Supplier Gross Profitability at Time (t+1)

	Supplier Gross Profitability at Time (***t+1***)
Customer Op. Profitability at Time (***t***)	0.195307754
N	60

If a customer firm experiences a reduction in operating profitability, it is more likely that this effect will influence supplier gross profitability than operating profitability, as it is less likely that supplier SG&A expenses is correlated with customer profitability. Overall the analysis shows that customer –and supplier profitability is correlated. Even though the correlation is weak when looking at future reactions of supplier profitability, it could be necessary to look at major shocks in order to find a causal relationship. The next section will look at cases where customers have experienced a profitability shock and how this might affect supplier profitability a year later.

5.2 Sample of profitability shocks

Given that the above analysis failed at finding significant correlation between customer profitability at time *(t)* and supplier profitability at time *(t+1)*, I investigate whether there could be a stronger relationship if using profitability shocks. The logic for using profitability shocks is that it is more likely that customer profitability will influence supplier profitability if there is a large change in customer profitability. A 5% change in customer profitability is less likely to affect supplier profitability than if there was to be a shock of i.e. 40%. For the analysis, I take a sample of 60 cases where the customer has had a shock to their gross profitability measure, and look at how this might affect supplier gross profitability at time *(t+1)*. For this analysis, I utilize gross profitability as Novy-Marx (2013) considers it to be the cleanest measure of accounting profitability. Moreover it is more likely to extract a causal relationship between customers and suppliers using gross profitability, since operating profitability includes a factor that shouldn't affect supplier profitability as a result of customer profitability shock (i.e SG&A).

The sample selection procedure is based on the following steps. First, I consider a shock to a customer's profitability to be an absolute change of more/less than 20%. The change from year to year is calculated as the absolute difference in gross profitability between time *(t+1)* and *(t)*[14]. I utilize a one-year lag between customer –and supplier gross-profitability, as it is less likely that a profitability shock to a customer causes an instantaneous effect on the supplier. I further require there to be a reported link of at least one year prior -and one year post the customer shock in order to increase the chances of the customer having an effect on supplier profitability. This will hence require there to be a reported link of at least three consecutive years.

As an example, I have provided a table below that shows an output of a particular customer firm (customer dummy equal to 1), and its respective supplier (supplier dummy equal to 1). I would in this situation require that the firm has one observation listed as a customer before a shock occurs (here 1991), and also a year after (1993). The change in gross profitability is calculated as the absolute difference between gross profitability in year 1991 to 1992. I am then interested in whether this has an effect on its supplier one year after the shock. We are

[14] Δ Gross profitability= gross profitability (t+1) – gross profitability(t)

hence interested in the difference in gross profitability of the supplier firm from 1992 to 1993.

Table 14. Example of a Profitability Shock using FEDEX and Air T Inc

gvkey	fyear	supplier	customer	firm name	gross_profitability	Δ gross_profitability
4598	2001	0	1	FEDEX Corp	.1837533	-0.0014538
4598	2002	0	1	FEDEX Corp	.3899902	.206237
4598	2003	0	1	FEDEX Corp	.3477057	-.0422846
1210	2001	1	0	Air T Inc	.5318517	.1084472
1210	2002	1	0	Air T Inc	.3720461	-.1598056
1210	2003	1	0	Air T Inc	.6060591	.2340129
1210	2004	1	0	Air T Inc	.5174416	-.0886174
1210	2005	1	0	Air T Inc	.5614681	.0440264

The example above indicates a positive relation between customer and supplier gross profitability with one-year lag. This could suggest that the profitability shock of Air T in 2003 was induced by the profitability shock of FEDEX in 2002. This example is consistent with the average throughout the sample. In fact, in a random sample of 60 customer/supplier relationships (given the criteria listed above), I find that 32/60 of the observations show that a shock to customer gross profitability in time *(t)* causes a reaction to the supplier gross profitability at time *(t+1)* in the same direction. Even though this relationship might seem weak, there are twice as many observations showing a strong reaction in the same direction than the opposite. If one disregards the very weak relationships (those with a supplier reaction below 5%), the effect is actually stronger. Now, almost 2/3 of the observations show that a positive (negative) shock to profitability causes a positive (negative) reaction to supplier profitability of at least 5%.

Table 15 Number of Observations of Going the Same/Opposite Directions After a Customer Profitability Shock

	Number of observations going the *same* directions			**Number of observations going *opposite* directions**		
	> ($^{+}/_{-}$) 20% shock to customer profitability causes a change in supplier profitability of:			> ($^{+}/_{-}$) 20% shock to customer profitability causes a change in supplier profitability of:		
% Δ in supplier gross profitability	< ($^{+}/_{-}$) 5%	($^{+}/_{-}$) 5%-10%	> ($^{+}/_{-}$) 10%	< ($^{-}/_{+}$) 5%	($^{-}/_{+}$) 5%-10%	> ($^{-}/_{+}$) 10%
N	8	9	15	14	6	8

In order to see some of the effects in detail, take OraSure Technologies (previously named Epitope Inc.), a pharmaceutical company specialized in diagnostic testing kits (i.e HIV OTC test). OraSure supplies oral specimen devices to LabOne for use in insurance testing. In 1996, 1997 and 1998, LabOne accounted for 27%, 39.5% and 28%(respectively) of OraSure's product revenues[15]. From 1996-1997, LabOne experienced a positive shock to their gross profitability of 40.6%. One year later, OraSure experienced a 26.7% profitability jump. Whether this jump is a direct result of LabOne's profitability is unclear, however it displays an interesting correlation between the two.

It should be noted however, that there is little evidence that specifically proves that the change in supplier profitability was in fact a consequence of the customer profitability shock. First, older annual reports were difficult to extract. Moreover, a lot of the firms has been merged, acquired, or gone bankrupt, causing annual reports challenging to find. Secondly, of those firms that I managed to extract annual reports through company websites or SEC filings, I failed at finding significant evidence that the reaction was in fact a direct consequence to the customer profitability shock. The findings above should therefore be taken with caution when looking at individual firms. Moreover, the customer shock analysis fails at providing statistically significant result. Regressing the difference in supplier profitability at time *(t+1)* on the difference in customer profitability at time *(t)* yields the following output.

Table 16. Regression of Customer Shock at Time (t) to Supplier Profitability Difference at Time (t+1)

	Δ Supplier Profitability at Time *(t+1)*
Customer Profitability Shock at Time *(t)*	0.0315
	(0.36)
Constant	-0.0150
	(-0.51)
N	60

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The table above shows that there is a positive relationship between customer profitability

[15] Epitope 1998 Annual Report, extracted from OraSure Technologies' website: http://phx.corporate-ir.net/phoenix.zhtml?c=99740&p=irol-reportsOther

shocks at time (t) and the difference in supplier profitability a year later. The problem however, is that one will be unable to reject a hypothesis that suggests that there is no casual relationship between customer profitability shock at time (t) and supplier profitability reaction at time (t+1).

5.3 Linking Profitability to Customer Momentum

Cohen & Frazzini (2008) showed that customers and suppliers are correlated in terms of revenue and operating income. Given that revenue and operating income are significant factors affecting profitability, it is likely that there is a correlation between customers and suppliers with respect to profitability as well. This was confirmed in the analysis in section 5.1, and in the results from the random sample of shocks to profitability in section 5.2. We also know that there is significant evidence suggesting that profitability and asset returns are related (Novy-Marx (2013), Fama & French (2014)). Specifically, high profitability stocks outperform low profitability stocks. This creates an interesting link. Could profitability be a significant factor explaining customer momentum? Cohen & Frazzini (2008) buy and sell supplier stocks whose customer has experienced a shock to their share price. Imagine that those customer stocks have (on average) high/low profitability. We already know that customers and suppliers are correlated in terms of profitability, so what if the supplier stocks being purchased/sold also have high/low profitability? As I do not have any details on the identity of the stocks being sold/purchased in Cohen & Frazzini (2008), nor any information about how many stocks they utilize in their strategy, I cannot test this directly. I can however, investigate whether the suppliers of customers with high (low) profitability, also have high (low) profitability.

In order to investigate this, I study the average gross profitability of the 25 (50)[16] worst performing customers and the 25 (50) best performing customers every fiscal year. I then look at the average supplier gross profitability that is linked to either the “bad” or ”good” customers. There will be a large difference in profitability between the average “bad” customer and the average “good” customer, but if their average suppliers show the same effect, then this could link profitability to customer momentum.

[16] For the details on the output using 50 firms, please see appendix Table A.3.

Table 17 shows the average profitability of the 25 best customers and 25 worst customers (by profitability). To the right of the table is average supplier profitability given the two customer groups. The important column in this table is the difference between the low/high supplier profitability.

Table 17. Average profitability of the 25 least profitable customers (low) and the 25 most profitable customers (high). To the right: average profitability of its linked suppliers[17]

	Customer			**Supplier**		
Fyear	Low Profitability	High Profitability	(High-Low)	Low Customer Profitability	High Customer Profitability	(High-Low)
1991	-0.0124	1.1991	1.2115	0.3074	0.3809	0.0735
1992	-0.0813	1.2588	1.3402	0.2819	0.4201	0.1382
1993	-0.1908	1.1811	1.3719	0.1434	0.4880	0.3446
1994	-0.1289	1.0491	1.1780	0.1173	0.4465	0.3293
1995	-0.1346	1.0544	1.1890	-0.0118	0.3577	0.3694
1996	-0.0962	1.1094	1.2056	0.1243	0.5233	0.3990
1997	-0.0754	1.1475	1.2229	0.3519	0.4115	0.0596
1998	-0.1386	1.1444	1.2830	0.2701	0.4053	0.1352
1999	-0.0968	1.2022	1.2990	0.1761	0.3790	0.2029
2000	-0.1281	1.2587	1.3868	0.2999	0.3419	0.0420
2001	-0.1156	1.1464	1.2620	-0.1479	0.5358	0.6837
2002	-0.1060	1.1109	1.2169	0.3014	0.3083	0.0069
2003	-0.1008	1.0935	1.1943	0.3500	0.4766	0.1266
2004	-0.0904	1.0219	1.1123	0.3745	0.4452	0.0707
2005	-0.1007	0.9957	1.0964	0.2040	0.3888	0.1848
2006	-0.1186	1.0308	1.1494	0.2517	0.4194	0.1677
2007	-0.1368	1.0747	1.2115	0.1379	0.4393	0.3015
2008	-0.1889	0.9624	1.1514	0.3934	0.2781	-0.1153
2009	-0.1014	0.9308	1.0322	0.4005	0.0842	-0.3162

The table shows that in 17/19 years there is a positive difference between the average supplier of the "good" customer and the average supplier of the "bad" customer. Moreover, this effect seems to be very strong. There are two outliers in this data set however. 2008 and 2009 show a negative difference between the suppliers of the "bad" and "good" customers. This negativity could be temporary, as firms during 2008 and 2009 were under significant

[17] 1990 is missing in the table, as there were too many observations missing for the year 1990.

pressure due to the financial crisis. The negative difference could also suggest that the correlation between customer and supplier profitability is reduced in newer times. The overall result however indicates that (at least in the extremes) customers and suppliers are related in terms of profitability. A similar picture also exists if doubling the amount of firms used in the analysis. Using 50 firms instead of 25 firms yields a positive difference between the average supplier of the "good" customer and the average supplier of the "bad" customer in 16/19 years (see Table A.3 in the Appendix). The difference is however stronger for the 25 firm case, suggesting the effect to be more present in the absolute extremes.

I link the above findings with customer momentum using the following idea. Assume that the high (low) customer return stocks that Cohen & Frazzini (2008) use to form portfolios of supplier stocks, also have high (low) profitability. Given that the linked suppliers also tend to have high (low) profitability, and that there exists a profitability premium in asset markets, this can in return induce return predictability across stocks that are economically linked. Up until now, no one has been able to explain the abnormal returns generated by Cohen & Frazzini (2008), and while this paper does not provide any empirical evidence that this is a profitability issue, it does point out an interesting link. To this date, no one has checked the customer momentum result found by Cohen & Frazzini (2008) up against profitability, even though profitability is known to affect asset returns.

Cohen & Frazzini (2008) test the result against several factors. Using Fama & French (1993), Carhart (1997) and Pastor & Stambaugh (2003) asset pricing models, they find that the customer momentum return is largely left unexplained. Moreover, Cohen & Frazzini (2008) also perform a number of robustness tests (see pp. 9-10), yet find that customer returns still predicts future supplier returns. A possible extension to this would therefore be to test the customer momentum results against a profitability factor. There are a few possible options to do this. First, one could test it against Hou, Xu & Zhang (2012)'s q-factor model that includes factor loadings such as market, size, investment, and ROE. Alternatively one can utilize Fama & French (2014) model that includes a profitability and investment factor. This would be interesting for observational purposes, however the model did fail all GRS tests. One can also attempt to use Fama & MacBeth (1973) regressions, and control for profitability similarly to Novy-Marx (2013). Given that Novy-Marx (2013) finds profitability to help explain most asset pricing anomalies (especially earnings-related anomalies), there is also a possibility that it can explain customer momentum as well.

Cohen & Frazzini (2008) argue that customer momentum stems from investor inability to extract relevant information about firms' major customers. It is important to note that I do not reject the idea provided by Cohen & Frazzini (2008), rather present other possible explanations that could be considered when evaluating the result. In fact, if my ideas about profitability affecting customer momentum are true, it is also not unlikely that profitability could be subject to some sort of investor inattention. If investors are unable to extract information about firms' major customers, then they are likely to miss this with respect to profitability as well. Buying/selling stocks whose customers have high (low) profitability, requires just as much attention (if not more) as the customer momentum strategy suggested by Cohen & Frazzini (2008). Given the economic links, it is easier to look at stocks with high/low returns shocks than having to physically look up the stocks with the highest/lowest profitability ratios, and will hence require more attention from the investor's point of view. Moreover, there is also evidence that links the profitability premium to investor inattention. In fact, Wang & Yu (2013) find investor inattention to be the likely cause of their profitability premium[18]. They find that the ROE effect is significantly stronger among firms suffering the most severe delay to new information, and in stocks with lower trading volumes. This suggests that the profitability premium is more pronounced in stocks that are more likely to have inattentive investors (Wang & Yu, 2013). Moreover, Wang & Yu (2013) show that past profitable (unprofitable) firms will experience positive (negative) earnings surprises around earnings announcements days. This is due to the investors initially underreacting to profitability, to later revise their expectations around announcement days.

[18] See section 2.4.5 in Litterary Review for more details.

6. Conclusion

Cohen & Frazzini (2008) find return predictability amongst assets that are economically linked. They argue that this predictability comes from investor limited attention. I have in this paper presented theories that could suggest that limited attention is not the sole factor affecting the customer momentum return. What started as an investigation on whether customers and suppliers differ fundamentally, ended with a proposition that profitability could be a significant factor affecting the customer momentum abnormal returns.

First, the result indicates that both size and profitability differ significantly between customers and suppliers. These differences are statistically significant and persistent over time. While the data generating process can partly explain size, profitability is more of a puzzling issue. I argue throughout this paper that the difference in profitability is likely to stem from difference in firm size. Given that operating leverage is much higher for supplier firms than customer firms, I argue that economies of scale and hence firm size cause this difference in profitability between customers and suppliers. It is however, very difficult to rationalize customer momentum using this difference in profitability. It was therefore necessary to look at profitability in general and how this might affect the return predictability.

Cohen & Frazzini (2008) find customers and suppliers to be correlated in terms of profits. Throughout the paper I find significant evidence suggesting that customer –and supplier profitability is correlated as well. Moreover, I show that suppliers of customers with high profitability significantly outperformed suppliers of customers with low profitability. Selected research also shows that profitability is a significant factor affecting asset returns. Combining my findings of profitability correlation with the evidence from the high (low) supplier profitability given extreme customer profitability, I argue that profitability may be a significant factor causing the customer momentum found by Cohen & Frazzini (2008). While the results do not show any empirical evidence, it does point out some interesting points that so far have been ignored when analysing customer momentum. Further research should examine the impact of profitability on customer momentum, and should test the findings of Cohen & Frazzini (2008) up against a profitability factor similar to that of Fama & French (2014). Moreover, it would be interesting if further research expanded the customer momentum strategy by using extreme customer profitability measures rather than

customer stock price shocks. Specifically, one would buy supplier stock if their respective customer has an extreme profitability measure.

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8. Appendix

Table A.1: Details for Ken French's 12 Industry Portfolios

1 NoDur Consumer NonDurables -- Food, Tobacco, Textiles, Apparel, Leather, Toys
0100-0999
2000-2399
2700-2749
2770-2799
3100-3199
3940-3989
2 Durbl Consumer Durables -- Cars, TV's, Furniture, Household Appliances
2500-2519
2590-2599
3630-3659
3710-3711
3714-3714
3716-3716
3750-3751
3792-3792
3900-3939
3990-3999
3 Manuf Manufacturing -- Machinery, Trucks, Planes, Off Furn, Paper, Com Printing
2520-2589
2600-2699
2750-2769
3000-3099
3200-3569
3580-3629
3700-3709
3712-3713
3715-3715
3717-3749
3752-3791
3793-3799
3830-3839
3860-3899
4 Enrgy Oil, Gas, and Coal Extraction and Products
1200-1399
2900-2999
5 Chems Chemicals and Allied Products
2800-2829
2840-2899
6 BusEq Business Equipment -- Computers, Software, and Electronic Equipment

	3570-3579
	3660-3692
	3694-3699
	3810-3829
	7370-7379
7 Telcm	Telephone and Television Transmission
	4800-4899
8 Utils	Utilities
	4900-4949
9 Shops	Wholesale, Retail, and Some Services (Laundries, Repair Shops)
	5000-5999
	7200-7299
	7600-7699
10 Hlth	Healthcare, Medical Equipment, and Drugs
	2830-2839
	3693-3693
	3840-3859
	8000-8099
11 Money	Finance
	6000-6999
12 Other	Other -- Mines, Constr, BldMt, Trans, Hotels, Bus Serv, Entertainment

Table A.2: Profitability Measures Given Different Industries

	Profitability for Consumer Non Durables		
	Supplier firms	*Customer Firms*	*All firms*
ROA	-0.00652	0.0641***	0.00830
	(-0.98)	(18.19)	(1.54)
N	1850	642	2322
Op. Profitability	0.100***	0.172***	0.115***
	(20.26)	(40.85)	(27.64)
N	1820	607	2259

t statistics in parentheses* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	Profitability for Consumer Durables		
	Supplier firms	*Customer Firms*	*All firms*
ROA	-0.00967	0.0211***	-0.00172
	(-1.56)	(4.60)	(-0.35)
N	1132	479	1468

Op. Profitability	0.103***	0.118***	0.105***
	(20.27)	(24.91)	(24.85)
N	1117	426	1401

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	Profitability for Manufacturing		
	Supplier firms	*Customer Firms*	*All firms*
ROA	0.00101	0.0384***	0.00940
	(0.09)	(14.68)	(1.09)
N	3037	1143	3920
Op. Profitability	0.102***	0.133***	0.109***
	(40.46)	(57.84)	(52.78)
N	2992	1085	3821

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	Profitability for Energy		
	Supplier firms	*Customer Firms*	*All firms*
ROA	-0.0216***	0.0367***	-0.00299
	(-4.37)	(8.82)	(-0.79)
N	1647	806	2247
Op. Profitability	0.0991***	0.154***	0.116***
	(22.38)	(37.21)	(33.09)
N	1596	765	2166

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	Profitability for Chemicals and Allied Products		
	Supplier firms	*Customer Firms*	*All firms*
ROA	-0.0250	0.0375***	-0.00316
	(-1.86)	(5.33)	(-0.34)
N	587	370	862
Op. Profitability	0.110***	0.150***	0.123***
	(13.60)	(25.45)	(21.42)
N	571	368	844

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	Profitability for Business Equipment Industry		
	Supplier firms	*Customer Firms*	*All firms*
ROA	-0.139***	-0.0257***	-0.117***
	(-16.29)	(-3.89)	(-16.25)
N	7235	2379	8786
Op. Profitability	0.000401	0.100***	0.0189***
	(0.08)	(26.15)	(4.49)
N	6969	2310	8462

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	'Profitability for Telecom		
	Supplier firms	*Customer Firms*	*All firms*
ROA	-0.118***	-0.0174*	-0.0669***
	(-7.45)	(-2.57)	(-7.61)
N	594	700	1197
Op. Profitability	0.0162	0.0984***	0.0541***
	(1.30)	(15.25)	(7.31)
N	473	488	903

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	Profitability for Utilities		
	Supplier firms	*Customer Firms*	*All firms*
ROA	0.0216***	0.0282***	0.0254***
	(4.25)	(23.99)	(12.05)
N	379	722	986
Op. Profitability	0.0342	0.107***	0.0568***
	(1.82)	(16.98)	(3.97)
N	53	34	74

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	Profitability for Shops (Wholesale, Retail ++) Industry		
	Supplier firms	*Customer Firms*	*All firms*
ROA	-0.0390***	0.0394***	0.0143***

	(-3.88)	(17.41)	(3.83)
N	977	2144	2962
Op. Profitability	0.0506***	0.138***	0.111***
	(7.26)	(72.40)	(40.14)
N	960	2115	2919

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	Profitability for Health Industry		
	Supplier firms	*Customer Firms*	*All firms*
ROA	-0.219***	-0.00323	-0.162***
	(-21.55)	(-0.49)	(-20.34)
N	2859	1264	3828
Op. Profitability	-0.0315***	0.141***	0.0231***
	(-3.91)	(24.08)	(3.74)
N	1845	1007	2610

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	Profitability for Money		
	Supplier firms	*Customer Firms*	*All firms*
ROA	-0.0319	0.0115	-0.0115
	(-1.23)	(1.29)	(-0.85)
N	159	185	330
Op. Profitability	0.0933***	0.131***	0.105***
	(5.62)	(18.64)	(10.17)
N	132	101	222

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	Profitability for Other		
	Supplier firms	*Customer Firms*	*All firms*
ROA	-0.0474**	0.0198***	-0.0252*
	(-2.96)	(4.97)	(-2.30)
N	3472	1775	5109
Op. Profitability	0.0624***	0.104***	0.0747***

	(4.24)	(17.76)	(7.00)
N	2439	1074	3417

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.3: To the left; Average profitability of the 50 least profitable customers(low) and the 50 most profitable customers(high). To the right; the average profitability of the suppliers linked to the customers with low profitability(low) and the average profitability of the suppliers linked to the customers with high profitability (high)

	Customer			**Supplier**		
Fyear	Low Profitability	High Profitability	(High-Low)	Low Customer Profitability	High Customer Profitability	(High-Low)
1991	0.0229	1.0154	0.9926	0.3528	0.3632	0.0104
1992	-0.0156	1.0510	1.0666	0.2751	0.2977	0.0226
1993	-0.0714	0.9957	1.0670	0.2549	0.3231	0.0682
1994	-0.0353	0.9470	0.9824	0.2086	0.4259	0.2173
1995	-0.0429	0.9364	0.9793	0.0367	0.3957	0.3589
1996	-0.0247	0.9898	1.0145	0.1909	0.3921	0.2012
1997	-0.0098	1.0047	1.0145	0.3143	0.3298	0.0155
1998	-0.0471	0.9981	1.0452	0.2369	0.2645	0.0277
1999	-0.0340	1.0247	1.0587	0.2043	0.2820	0.0778
2000	-0.0549	1.0354	1.0902	0.2115	0.3768	0.1653
2001	-0.0442	0.9640	1.0082	0.1507	0.3797	0.2290
2002	-0.0354	0.9265	0.9618	0.2664	0.3125	0.0461
2003	-0.0252	0.9247	0.9499	0.2872	0.3714	0.0842
2004	-0.0217	0.8812	0.9029	0.3277	0.3071	-0.0205
2005	-0.0217	0.8598	0.8816	0.2391	0.3867	0.1475
2006	-0.0298	0.8932	0.9230	0.3062	0.3059	-0.0003
2007	-0.0441	0.8955	0.9396	0.3177	0.3873	0.0696
2008	-0.0779	0.8212	0.8991	0.3359	0.3885	0.0526
2009	-0.0224	0.7452	0.7676	0.2956	0.1269	-0.1687