**Overreaction to growth opportunities: an explanation of the asset growth anomaly**

Charlie X. Cai\*, Peng Li\*\* and Qi Zhang\*\*\*

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**Abstract**

The negative relation between asset growth and subsequent stock returns is referred to as the asset growth anomaly. We propose that overreaction to growth opportunities is the source of the asset growth anomaly. This suggests that growth, as opposed to mature, firms and firms with longer series of asset growth should experience a stronger asset growth anomaly. Our evidence supports these predictions. ­­

Keywords: Asset Growth, Anomaly, Overreaction, Growth Opportunities, US market

GEL codes: G1, M4

\* Corresponding Author; Professor of Finance, University of Liverpool Management School, University of Liverpool, Chatham Street, Liverpool, L69 7ZH, UK. Email: x.cai7@liverpool.ac.uk.

\*\* Centre for Advanced Studies in Finance (CASIF), Leeds University Business School, University of Leeds, Leeds, LS2 9JT, UK. Email: p.li@leeds.ac.uk.

\*\*\* Reader in Finance, Durham University Business School, Durham University, Durham, DH1 3LE, UK. Email: qi.zhang2@durham.ac.uk.

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1. Introduction

The efficient market hypothesis has faced a long line of challenges from anomalies (see Schwert, 2003, for a survey). The asset growth anomaly (where subsequent returns are negatively related to asset growth) is one of the latest challenges to be investigated. Cooper, Gulen and Schill (2008) and Fama and French (2008) show that firms with high asset growth have lower future returns: that is, firms earn lower subsequent returns when they expand their assets; whereas firms earn higher subsequent returns when they experience a contraction of their assets[[1]](#footnote-1). Furthermore, as the Fama-French 3-factor model cannot explain the returns of portfolios sorted by asset growth, this negative relationship between asset growth and future stock returns at the cross-sectional level is referred to as the asset growth anomaly.

While both mispricing and rational explanations of the asset growth anomaly have been proposed, much of the recent evidence in the literature has been focused on rational explanations via Q theory and it is largely inconclusive[[2]](#footnote-2), with mispricing as an explanation receiving a lot less attention. Given the mixed evidence to date, the purpose of this paper is to extend our understanding of the drivers of this anomaly by focusing on investor overreaction as an explanation of the asset growth anomaly. Such a conjecture has its origin in the anomaly literature (Cooper et al., 2008). If the asset growth anomaly is driven by investor overreaction to asset growth news, it follows that growth firms will be more likely to experience such an anomaly as they should have more growth news to be extrapolated by investors.

We, therefore, develop two hypotheses relating to investors’ reaction to growth. First, if overreaction to growth is the explanation of the anomaly, then growth firms should show a stronger asset growth anomaly than mature firms[[3]](#footnote-3). Second, the behavioral bias of representativeness suggests investors tend to overreact more to a series of events and, therefore, if overreaction is the explanation, firms experiencing a longer series of high (low) asset growth should experience lower (higher) subsequent return. In other words, the anomaly will be stronger for firms experiencing a sequence in their growth pattern[[4]](#footnote-4). It is often argued that investors extrapolate a sequence of same signed news that results in an overreaction to the information (see, for example, the theoretical model of Barberis, Shleifer and Vishny, 1998)[[5]](#footnote-5).

To test the first hypothesis we employ three growth type proxies: retained earnings scaled by firm total assets (RE), the dividends to income ratio (DIV) and cash flows scaled by firm total assets (CF). Growth firms tend to have less retained earnings, fewer dividends and lower cash flows than mature firms (see Anthony and Ramesh, 1992; DeAngelo et al., 2006; Dickinson, 2011). Using US data from 1963 to 2011, we show, by comparing the hedge returns of asset growth sorted portfolio for growth and mature firms, that growth firms have a stronger asset growth anomaly. By sorting asset growth within growth firms and mature firms, the annualized return difference between growth firms and mature firms is 20%, 18% and 13% respectively for three proxies of growth type--RE, DIV and CF. The Fama-MacBeth regression results provide further support. For example, they show that the slope of asset growth for growth firms is -0.0124, while it is -0.0042 for mature firms when the growth type proxy is RE.

To test the second hypothesis, we construct four asset growth sequence portfolios for high and low asset growth firms respectively. For high asset growth sequence portfolios, we construct four portfolios for firms that experience high asset growth (in the top two asset growth deciles) in one year and consecutively for two, three, and four years respectively. The four low asset growth sequences are constructed similarly. We find, by comparing the slope of each growth sequence portfolio, that as the asset growth sequence increases the asset growth anomaly becomes stronger. This is especially the case for high-growth sequences. In addition to univariate tests, we further examine the interactive effect between growth type and asset growth and between the growth sequence and asset growth after controlling for the two prominent explanations of the asset growth anomaly—limits-to-arbitrage and q theory with investment frictions. We use five limits-to-arbitrage proxies including idiosyncratic volatility, bid-ask spread, analyst coverage, dispersion of analysts’ forecasts and dollar trading volume and two investment frictions proxies including firm age and firm total assets. In the majority of cases, the evidence suggests that growth firms and longer growth sequences make the asset growth anomaly stronger. The evidence of investor overreaction only to positive sequences but not to the negative sequences provides further support to the argument that it is ‘Growth’ that investors overreact to.

In summary, we find strong evidence to support the overreaction explanation of the asset growth anomaly. Our paper contributes to the literature in the following ways. Complementing evidence from Cooper et al. (2008) we provide strong evidence that a firm’s growth status affects the reaction of investors to its news of asset growth. More importantly, we provide new evidence to support that overreaction is a key driver of the asset growth anomaly. Therefore, growth type and growth sequence are able to capture investors’ overreaction and provide additional information to explain the asset growth anomaly[[6]](#footnote-6).

The prior literature related to mispricing explanations mainly test whether firms with different limits-to-arbitrage levels show different degrees of the asset growth anomaly (Lam and Wei, 2011; Watanabe et al., 2013). However, the limits-to-arbitrage approach only studies the constraints to the correction to the initial mispricing, it does not explicitly analyze whether the mispricing is due to over- or under-reaction. We contribute to this line of literature by studying the source of mispricing: overreaction.

However, Cooper et al. (2008) provide some evidence on testing the overreaction to past earnings. They show that investors are indeed surprised by the subsequent bad (good) earnings for the high (low) asset growth firm. Although such evidence supports that it is expectation errors that causes mispricing (Laporta et al., 1994), it does not identify the sources of expectation errors explicitly. We show that it is investors’ overreaction to growth opportunities that drives expectation errors and causes the anomaly.

We contribute to the literature by testing the overreaction to growth in a sequential setup. Our unique research design enables us to show that there are elements of the asset growth anomaly that can be explained by investors’ overreaction. The explanatory power of the overreaction explanation still exists even when we control for limits-to-arbitrage and q theory, which means firm growth type and growth sequence are able to reflect investors’ overreaction to asset growth information.

The remainder of the paper is organized as follows. We review the extent asset growth anomaly literature and construct our hypotheses in section 2. We describe the data and variables used in this study in section 3. In section 4 we present empirical results for the asset growth anomaly for growth and mature firms, while in section 5 we show results for the growth sequence portfolios and the representativeness explanation. We provide conclusions in section 6.

**2. Related literatures and hypothesis development**

To develop our two hypotheses concerning the overreaction to growth being an explanation of the asset growth anomaly, we first review briefly the mispricing with limits-to-arbitrage and Q theory with investment frictions literatures in section 2.1. Then we develop two hypotheses in section 2.2.

2.1 Mispricing with limits-to-arbitrage and Q theory with investment frictions

Two branches of the explanations are proposed in the literature: risk-based (rational) and mispricing (behavioral) explanations. Regarding the risk-based explanation, upon discovery of the asset growth anomaly, Cooper et. al. (2008) test the risk-based explanation and show that standard risk factors such as three-factor models and conditional CAPM model using a standard set of macroeconomic variables cannot explain the effect. They also show that the asset growth effect is not consistent with the theoretical papers’ implication that expected returns should systematically decline in response to increasing investment. Therefore, they reject the explanation of time-varying risk induced by changes in the mix of firm growth options and assets in place. Overall, Cooper et al. (2008) dismiss the rational risk-based explanation of the asset growth anomaly.

More recent searches for a rational explanation shift from an investor to a firm point of view. Q theory suggests that firms invest when the discount rate (expected return) is lower because a lower discount rate leads to a higher net present value and consequently, a negative investment-return relation is observed (e.g., Cochrane, 1991; 1996). However, such a prediction is difficult to test empirically since managerial expectations of a discount rate are unobservable and it requires the strong assumption of market efficiency to make connections between managerial expected discount rates and subsequent realized stock returns. As a way forward, Li and Zhang (2010) construct an optimal investment model by incorporating investment frictions to Q theory. Firms with high investment frictions produce higher investment costs and are, therefore, not as sensitive to changes in the discount rate; that is, only large decreases in the discount rate can induce firms with high frictions to invest. If Q theory is the reason behind the asset growth anomaly, it predicts that firms with higher investment frictions should show a stronger asset growth anomaly. Q theory with investment frictions has received support in the literature; for example, Chen and Zhang (2010) develop a three-factor model based on Q theory and find supportive evidence.

A parallel development of the literature is the mispricing explanation of the asset growth anomaly. Cooper et al. (2008) argue that the asset growth anomaly reflects investor overreaction to firm growth (contraction). They find that firms that grow (contract) tend to be firms with future negative (positive) profitability shocks with respect to performance in the sorting year. Furthermore, they show that subsequent earnings announcements for low growth firms are associated with positive abnormal returns and *vice versa*. The results are consistent with the La Porta, Lakonishok, Shleifer, and Vishny (1997) expectation errors mispricing story.

Further developments in this line of research focus more on the condition for the mispricing to persist after it occurs; namely, limits-to-arbitrage. Both Li and Zhang (2010) and Lam and Wei (2011) propose that if mispricing leads to the asset growth anomaly, firms with high limits-to-arbitrage should show a stronger asset growth anomaly than firms with low limits-to-arbitrage. The reason is that the anomaly cannot be traded away quickly and should last for longer periods when there are high limits-to-arbitrage such as high transaction costs, high stock volatility and/or little information about the firm. It is important to note that these studies do not directly study the underlining cause of the mispricing. There is an implicit assumption that mispricing occurs in the market and arbitrage fails to fully correct the mispricing.

Lipson, Mortal and Schill (2011) find that firms with high transaction costs have a stronger asset growth anomaly which is consistent with the mispricing with a limits-to-arbitrage explanation. Li and Zhang (2010) and Lam and Wei (2011) compare the explanations of mispricing with limits-to-arbitrage and Q theory with investment frictions. Li and Zhang (2010) find the explanatory power of mispricing with limits to arbitrage is stronger than Q theory. With a more comprehensive set of proxies for limits to arbitrage and investment frictions, Lam and Wei (2011) show that the two explanations have similar explanatory power in terms of the asset growth anomaly; and they consider the high correlation between the limits-to-arbitrage and investment frictions proxies as a key issue in trying to distinguish between the two explanations. More recently, as an attempt to address this issue, Titman, Wei and Xei (2013) and Watanabe et al. (2013) undertake cross-country studies and find a stronger asset growth anomaly in more developed stock markets that is consistent with dynamically optimal investment; that is, they find support for Q theory.

In summary, while the literature finds support for both Q theory with investment frictions and mispricing with limits-to arbitrage to explain the asset growth anomaly, recent studies have focused more towards the Q theory explanation. Mispricing as an explanation of the phenomenon has received less attention since Cooper et al.’s early analysis. Importantly, recent studies on the mispricing explanation only focus on the condition of the subsequent persistence of mispricing rather than the cause of the initial pricing. This study aims to fill this void.

2.2 Testable hypotheses

In this study, we investigate how investors react to firm growth information and examine how far the overreaction can be related to the representativeness heuristic.

Lakonishok, Shleifer and Vishny (1994) indicate that investors extrapolate firm performance too far into the future and, therefore, push the price too high or too low causing a subsequent reversal. Their argument implies that investors overreact to a firm’s prospects. In essence, investors display unrealistic views about firms’ prospects and have an inability to forecast (e.g., Weinstein, 1980; Buehler, Griffin and Ross, 1994).

Growth firms are usually characterized as relatively young and small, and have less information available but have more growth opportunities or better growth prospects. In contrast, mature firms are characterized as having long histories, large size and more information available but less growth opportunities. Therefore, investors should overreact more to growth firms due to their greater growth opportunities than mature firms. These arguments lead to our first hypothesis.

***H1.*** *Growth firms should show a stronger asset growth anomaly (negative relation between asset growth and stock returns) than mature firms because of the overreaction to greater growth opportunities.*

Barberis, Shleifer and Vishny (1998) argue that investors tend to confirm the sequence when investors witness a growth surprise followed by another surprise and this is consistent with representativeness[[7]](#footnote-7). It indicates that the longer is the asset growth sequence the stronger should be the asset growth anomaly. Specifically, when investors see a series of high asset growth consecutively they believe the sequence will continue and push the price to a high level; and they push the price to an even higher level when the series is longer. Afterwards, when investors recognize the reality and correct their valuation, the stock prices reverse. As a result, a negative relation between asset growth and subsequent returns should be observed[[8]](#footnote-8). If this is the case, the findings will tend to support overreaction as the explanation of the asset growth anomaly and, furthermore, the representativeness heuristic will be the underlying driver of the overreaction. Hence, we develop our second hypothesis.

***H2.*** *Firms with longer asset growth sequences should display a stronger asset growth anomaly (a negative relationship between asset growth and stock returns), ceteris paribus, than firms with a shorter asset growth sequence because of the representativeness bias.*

3. Data and variables

3.1 Sample selection

We use US data including NYSE, Amex and NASDAQ from 1963 to 2011 based on the CRSP and Compustat datasets. Monthly stock returns are from CRSP and yearly financial reporting variables are from Compustat. Also, we exclude financial firms with four-digit SIC codes between 6000 and 6999[[9]](#footnote-9). For analyst data, i.e. the number of analysts covering a firm and the dispersion in analyst forecasts, we start from 1977 due to the availability of data. To avoid the problems of survivorship or selection biases, we follow Fama and French (1993) and Cooper et al. (2008) to retain firms with at least two years of Compustat data[[10]](#footnote-10). There are 172,732 firm-year observations after following the sample selection procedure. For some portfolio formations, we require four-years of data availability prior to the formation date. For our Fama-MacBeth regressions, we update returns monthly and asset growth or other financial variables on a yearly basis.

3.2 The measurement of asset growth

Following Cooper et al. (2008) we use the percentage change of a firm’s assets between the current and previous year as the measure of firm asset growth. That is, firm asset growth (AG) = Assett-1/Assett-2-1. Lipson et al. (2011) compare different definitions of asset growth and show that there is little effect on the asset growth anomaly (the construction of asset growth and the following proxies are detailed in the appendix.)

3.3 Proxies of growth type

We use three measures to proxy the growth stage of a firm. The first is retained earnings divided by total assets (RE). DeAngelo, DeAngelo and Stulz (2006) show evidence that retained earnings as a proportion of total assets is a good proxy of the growth stage - i.e., firms with a high RE are in the maturity stage while firms with low RE are more likely to be growth firms. They find a strong positive relation between RE and dividends; specifically, high RE firms have more motivation to distribute dividends because they have less investment opportunities and have enough ability to self-finance; in contrast, low RE firms are not likely to be dividend payers due to the fact that they face abundant investment opportunities and, therefore, it is not desirable to pay dividends. This leads to our second proxy.

The second proxy of the growth stage is dividends scaled by income (DIV) which is used in previous literature (e.g., Anthony and Ramesh, 1992; Bulan, Subramanian and Tanlu, 2007). Following Anthony and Ramesh (1992), we classify high DIV firms as mature firms and low DIV as growth firms. DeAngelo, DeAngelo and Stulz (2010) show that these dividend groups are reasonable proxies for lifecycle stage.

The third proxy is cash flow scaled by total assets (CF). Growth firms have a large investment opportunity set and invest more than the cash they can generate so they are characterized by low cash flow (e.g., Dickinson, 2011). In contrast, mature firms have the ability to generate high cash flows.

3.4 Proxies of investment frictions

We use two proxies for investment frictions. The first is firm size which is measured by total assets (ASSET). The market usually has less information about small firms which are not attractive to investors and lack attention; both Li and Zhang (2010) and Lam and Wei (2011) use asset size as a proxy of investment frictions.

Another proxy for investment frictions is firm age (AGE). Younger firms have less information available in the market because they have shorter histories (e.g. Barry and Brown, 1985; Zhang, 2006). Without sufficient information, younger firms face greater financing constraints.

3.5 Proxies of limits-to-arbitrage

Our limits-to-arbitrage proxies include analyst coverage (COV), dispersion in analyst forecast (DISP), bid-ask spread (BAS), idiosyncratic volatility (IVOL), and dollar trading volume (DVOL).

Analyst coverage (COV) measures the number of financial analysts on the presumption that the greater the number the more investors will be able to access information related to the firm. As a result, investors can make more reliable decisions with more information, that is, there is low risk. Lam and Wei (2011) find that the asset growth anomaly is stronger for firms with high limits-to-arbitrage and use analyst coverage as a limits-to-arbitrage proxy. Hong, Lim and Stein (2000) argue lower analyst coverage means higher information uncertainty.

The second proxy is the dispersion in analysts’ forecasts (DISP). It reflects the disagreement in analysts’ forecasts. The extent of dispersion is positively related to information uncertainty (e.g. Barron and Stuerke, 1998; Diether, Malloy and Scherbina, 2002; and Zhang, 2006) - a greater dispersion implies greater risk.

The third proxy is the bid-ask spread (BAS). With a larger bid-ask spread suggesting higher transaction costs (e.g., Lam and Wei, 2011). The higher transaction costs would set constraints to arbitrage behavior. Therefore, a large bid-ask spread means higher limits-to-arbitrage.

The fourth proxy is idiosyncratic volatility (IVOL). Unlike total return volatility, idiosyncratic volatility measures the firm-specific risk or unsystematic risk. It is seen as measuring arbitrage risk in terms of firm-specific information (e.g. Pontiff, 1996; Wurgler and Zhuravskaya, 2002; and Ali, Hwang and Tronmbley, 2003).

The fifth proxy is dollar trading volume (DVOL). With higher dollar trading volume indicating more activity in a stock; namely, there should be low limits-to-arbitrage when the trading volume is high (e.g., Lam and Wei, 2011).

3.6 Sample summary statistics

Table 1 presents the sample summary statistics. Panel A reports the means of firm characteristics. Growth firms can be characterized as firms with low total assets and younger firms, while mature firms have larger total assets and a long history. In addition, growth firms usually have larger bid-ask spreads, a greater dispersion of analysts’ forecasts and higher idiosyncratic volatility than mature firms. In addition, growth firms have fewer analysts and a lower dollar trading volume.

[Insert Table 1 about here]

Panel B in Table 1 reports the correlations across the limits-to-arbitrage and investment friction proxies. As analyst coverage (COV), dispersion in analysts’ forecasts (DISP), bid-ask spread (BAS), idiosyncratic volatility (IVOL) and dollar trading volume (DVOL) reflect the level of limits-to-arbitrage, the proxies are highly correlated. For example, dollar trading volume (DVOL) has a Pearson (Spearman) correlation of -51.3% (-75.0%) with bid-ask spread (BAS) and a correlation of 60.7% (77.7%) with analyst coverage. Similarly, firm total assets (ASSETS) and firm age (AGE) are correlated because both of them contain information concerning investment frictions. The Pearson and Spearman correlations are 42.0% and 37.0%. Further, limits-to-arbitrage proxies (COV, DISP, BAS, IVOL and DVOL) and investment friction proxies (ASSET and AGE) are correlated. For Pearson correlations (below the diagonal), firm total age (AGE) and dollar trading volume (DVOL) have a correlation of 27.8%; correlations between firm asset (ASSET) and analyst coverage (COV), bid-ask spread (BAS), idiosyncratic volatility (IVOL) and dollar trading volume (DVOL) are 40.7%, -46.0%, -42.7% and 73.4% respectively. Above the diagonal are the Spearman rank-order correlations and they show a similar but even higher set of correlations in most cases between the proxies of limits-to-arbitrage and proxies of investment frictions. Given the level of these correlations, it is difficult to distinguish whether limits-to-arbitrage or investment frictions might explain the asset growth anomaly. Lam and Wei (2011) show that neither of the two dominates the other and Watanabe et al. (2013) argue that due to the high correlation between limits-to-arbitrage and investment frictions they not surprisingly produce similar predictions. Our analysis using a growth and mature firm typology seems to be capturing key cross-sectional variations in the investment friction and limits-to-arbitrage measures. It is, therefore, important to examine if investors react differently to growth and mature firms after controlling for these factors.

4. Growth type and asset growth anomaly

Two methodologies are used to examine whether growth firms show a stronger asset growth anomaly: sorts of returns according to asset growth and the interactive effect of growth type and asset growth by using Fama-MacBeth regressions[[11]](#footnote-11). Sorts of returns are used to display the basic pattern of the comparison of asset growth effect between growth firms and mature firms. The interactive effect regressions with control of limits-to-arbitrage and investment frictions show the unique information contained by growth type.

4.1 Sort

We first divide firms into two categories—growth and mature based on three growth type proxies—retained earnings scaled by total assets (RE), the dividend to income ratio (DIV) and cash flow scaled by total assets (CF). Specifically, we rank firms based on each of the growth type proxies into deciles. The three bottom deciles are defined to belong to the growth group, while the top three deciles are defined as belonging to the mature group. Following Fama and French (2008) and Lam and Wei (2011), we sort firms into deciles based on asset growth in year t-1 and calculate average monthly returns from July in year t to June in year t+1 for each asset growth decile.

Table 2 examines the asset growth anomaly for growth firms and mature firms by sorting. Table 2 reports the monthly raw returns and Fama-French alphas for both equal- and value-weighted portfolios. Panel A presents equal weighted raw return, for each growth type proxy, future monthly returns decrease as the asset growth increases for both growth and mature firms. The difference of returns between low asset growth stocks and high asset growth stocks are significantly positive (the t statistics are corrected by the Newey-West (1987) method). These initial results show that both growth firms and mature firms display the asset growth effect and this confirms that this anomaly exists for the US market. Further, the spread of hedge returns between growth and mature firms are reported in row Spread (G-M). For the following three growth type proxies—retained earnings (RE), dividend (DIV) and cash flow (CF), the spreads are 1.5%, 1.0% and 1.3%, respectively. All the three spreads are significant at the 1% significance level and indicate that growth firms have a stronger asset growth anomaly.

When firm size is taken into consideration through value weighted construction, Panel B shows further support that the asset growth anomaly is much stronger in growth firms than in mature firms. Specifically, the asset growth anomaly is not a significant phenomenon in the mature firm, while there is a significant anomaly documented in two out of the three growth type portfolios.

A similar conclusion can be drawn when the Fama-French regression alphas are considered in Panels C and D. Overall, the sorting analysis demonstrates that the asset growth anomaly is stronger in growth firms.

[Insert Table 2 about here]

4.2 Regression

The above univariate analyses show a stronger asset growth effect for growth firms. In this sub-section we examine the marginal effect of growth type on the asset growth anomaly and whether the growth type has additional information concerning the asset growth anomaly after controlling for limits-to-arbitrage and investment frictions. As in sub-section 4.1, we group firms into deciles based on each of the three growth type proxies. Then we assign -1 to mature firms, 1 to growth firms and 0 to the rest. We run a Fama-MacBeth regression with an interaction term between growth type and asset growth to capture how growth type affects the slope of asset growth. In each month, we first run the following cross-sectional regression from 1963 to 2011:

*Eq(1)*

Where is the monthly return updated monthly; AG is asset growth which is updated on an annual basis; GT indicates growth type with -1 for mature firms, 1 for growth firms and 0 for the rest; control variables include the natural logarithm of market value (lnMV), the natural logarithm of the book-to-market ratio (lnBM) and prior six month returns (Pre6ret) which are widely used predictors of cross sectional returns.

Table 3 summarizes the regression results. For each growth type proxy, the slopes of the interaction term between growth type and asset growth are significant and negative for all three proxies of growth type. These results support our first hypothesis that the asset growth anomaly is much stronger for growth firms. Interestingly, the uninteractive asset growth coefficient for the RE regression is insignificant which suggests that after control for growth type proxied by RE, the original asset growth anomaly has disappeared.

[Insert Table 3 about here]

We next examine whether growth type is subsumed by the limits-to-arbitrage and investment friction explanations. As noted in the discussion of correlations in section 3.6, proxies are correlated within and between the limits-to-arbitrage and investment frictions groups. To address this multicollinearity issue, following Watanabe et al. (2013) we control for limits-to-arbitrage and investment friction proxies separately. We run regressions from 1963 to 2011 but due to the availability of data, for some proxies the regressions start from when the data are available. For example, analyst data are available from 1997, hence we run regressions from 1997 when we control for analyst forecasts and the dispersion of analyst forecasts. In each month, we run the following cross-sectional regression:

*Eq(2)*

Where LIproxy is a proxy of the limit-to-arbitrage or investment frictions. Table 4 presents the slope of the interaction between asset growth and the growth type. Panels A to C capture the results for each of the three growth type proxies – RE, DIV and CF. In each panel we control for the five limits-to-arbitrage proxies and the two investment friction proxies; giving us 21 regressions in total across the three panels. The results for growth type RE (Panel A) show that six out of seven regressions have significantly negative coefficients for the interaction between growth type and asset growth. This suggests that the results for growth type proxied by RE are robust to most of the control of existing explanations. The results in Panel B shows similar finding but weaker with four out of the seven regressions displaying significantly negative coefficients for the interaction between growth type and asset growth. Finally, the results for growth type CF (Panel C) show that its effects are robust to the control of only one limit-to-arbitrage (Model 1) and one investment friction (Model 7). This is partly as expected as firms with lower cash flow are more likely to have higher investment frictions. On balance, these sets of regression results show that the growth type of a firm has some additional information in explaining the relationship between asset growth and stock returns after controlling for limits-to-arbitrage and investment frictions.

[Insert Table 4 about here]

5. Asset growth sequence and asset growth anomaly

5.1 Univariate analysis

The above results show that growth firms have a stronger asset growth anomaly and this gives support to the overreaction explanation. Further, if the asset growth anomaly is driven by overreaction, we expect the sequence of asset growth to affect the asset growth anomaly. More specifically, we argue that investors overreact to firm asset growth when they see a growth sequence; and as the sequence becomes stronger, investors overreact more.

To construct asset growth sequence portfolios we first divide firms into deciles in the June of each year based on asset growth. Then we look back to find which asset growth decile the firm is allocated to in previous years. The top two asset growth deciles are considered as the high asset growth group, while the bottom two asset growth deciles are viewed as the low asset growth group. H1 refers to the portfolio at the portfolio formation date such that a firm is in the high asset growth group and stays in the high asset growth group from the previous year. *Hi* means that a firm stays in the high asset growth group from the previous *i* years (where *i=2, 3, or 4)*. We repeat this procedure for the low asset growth group that is labeled as *L1* to *L4*.

To examine whether returns decrease (increase) with the increase of the high (low) asset growth sequence, we show equal-weighted average monthly returns for each growth series portfolio. Further, we examine the slope of the asset growth regression in each portfolio to investigate whether the asset growth anomaly is stronger with an increase in the asset growth sequence.

Panel A in Table 5 shows the return pattern of the growth sequence portfolios. For the high asset growth sequence, the equal-weighted returns reported in the *Ret* column are decreasing monotonically from H1 to H4, i.e., from 0.86% to 0.36%. The difference between H4 and H1 is significantly negative indicating firms with a longer sequence of high asset growth have lower returns in the near future. For the low asset growth sequence, the equal-weighted returns do not show a monotonic pattern that returns increase with an increase in the asset growth sequence; nevertheless, the significantly positive return difference between L4 and L1 confirm our expectation. When we consider the hedge return in each Sequence group, the return of L – H are all positive and significant which confirm the asset growth effect in all groupings. Furthermore, this hedge return monotonically increases from Sequences 1 to 4 and the difference between the longest and shortest sequence is statistically significant. Economically, investing in the hedge portfolio of the longest growth sequence will have more than double of the return (1.73%) in that of the shortest growth sequence (0.83%). Overall, the evidence is consistent with investors behaving according to the representativeness heuristic. That is, returns become smaller with more consecutive years of high asset growth whereas returns increase when the sequence of low asset growth increases.

In a further test, we directly analyze whether the asset growth anomaly increases as the strength of the asset growth sequence increases by using the asset growth regression. Within each asset growth sequence portfolio, we employ a Fama-MacBeth regression that controls for the natural logarithm of market value, the natural logarithm of the book-to-market ratio and the previous 6-month returns. The slope coefficients are reported in Panel B in Table 5. For the high asset growth sequence, most of the slopes of asset growth are significantly negative, confirming the asset growth effect. The slope difference of H1 and H4 is 0.0676 and significant at the 10% level. It suggests that firms with a longer asset growth sequence show a stronger asset growth anomaly. In contrast, for low asset growth sequences, there is only very weak evidence of the asset growth anomaly and the slope difference between L1 and L4 is not significant. The asymmetric pattern suggests that the asset growth anomaly is mainly driven by an overreaction to high asset growth. This further confirms that the asset growth anomaly is more likely to be caused by investors’ appetite for growth (the high growth sequence) rather than contraction (the low growth sequence). The asset growth slop coefficients for portfolios including both high and low growth firms in each sequence further support our second hypothesis that the asset growth anomaly is stronger for firms with a longer sequence of asset growth.

[Insert Table 5 about here]

5.2 Multiple regression

In this sub-section, we test whether the sequence of asset growth influences the asset growth anomaly after controlling for limits-to-arbitrage and investment friction proxies. We perform Fama-MacBeth regressions of monthly returns on asset growth, interacting between the asset growth sequence and asset growth, limits-to-arbitrage or investment friction proxies, firm size, book-to-market ration and prior six-month returns. Given the correlation within and between the limits-to-arbitrage and investment friction proxies, following the procedure in section 4.2 we include them in separate regressions. In each month, we run the following cross-sectional regression:

*Eq(3)*

Where is the monthly return updating monthly; AG is asset growth which updates on an annual basis; high and low sequences are the length of the sequence; and each time we use one proxy either from the limits-to-arbitrage or the investment frictions groups; control variables include the natural logarithm of market value (lnMV), the natural logarithm of the book-to-market ratio (lnBM) and prior six month returns (Pre6ret) which are widely used predictors of cross sectional returns.

Table 6 reports the slope of interaction between asset growth sequences and asset growth. Model 1 has no limits-to-arbitrage and investment friction proxies. From models 2 to 6 we control for limits-to arbitrage proxies and we control for investment friction proxies from Models 7 to 8. The slope of the interaction of the high asset growth sequence and asset growth is significantly negative. Models 2 to 8 show a significantly negative slope of the interaction term for the high asset growth sequence except when controlling for idiosyncratic volatility, analyst forecast dispersion and firm age. To summarize, the results support the prediction that there is a stronger asset growth anomaly when the asset *growth* sequence is longer and, therefore, they give support to the argument that overreaction is the mechanism that drives the asset growth anomaly and representativeness is the heuristic that strengthens the relationship.

[Insert Table 6 about here]

6. Robustness test and further evidence

6.1. Effect of past growth

Our analyses in the previous section show that the asset growth effect is stronger when there is a longer sequence of growth pattern. Cooper et al (2008) show that asset growth can affect future return beyond the first year. Our analyses of the asset growth effect at the end of a growth sequence in the previous section could potentially capture the spillover effect of previous growths. To resolve this concern, we rerun our analysis including previous three periods of asset growth as a control for each asset growth sequence regressions. The results are reported in Table 7. It shows that the asset growth slop coefficients are in general increases as the sequence increase which is consistent with the findings in Table 5 Panel B. Particularly, after controlling for the effect of past growth, it shows that investors’ overreaction increased with the sequence only after they observed more than two subsequent growths (Sequence=3). Overall, we findings are robust to the control of past growth.

 [Insert Table 7 about here]

6.2. Further evidence on overreactions

So far, our test for the overreaction explanation follows traditional set up by studying the return reversal pattern after growth. If investors’ overreaction to growth as an explanation to the anomaly, it will expect that there is evidence of price overreaction to growth information during the formation period. We study this possibility by running regression analyses of contemporary return explained by asset growth and further interactive with growth types and growth sequence.[[12]](#footnote-12) Table 8 reports the regression results. The regression setup is similar to those we have been used to study asset growth effect in Tables 3 and 7 for the growth type and sequence respectively. The only difference is the dependent variable in Table 8 is return during the formation period instead of the subsequent returns.

[Insert Table 8 about here]

Panel A in Table 8 shows that the asset growth slop coefficients are significant and positive which is opposite to the sign in the regressions using future returns in Table 3. This confirms that the subsequent reversal effect is indeed driven the price movement conditional on asset growth during the formation period. Furthermore, supporting our hypothesis, growth type demonstrate additional explanatory power in investors’ overreaction to growth. The interactive terms of asset growth and two out of the three proxies (DIV and CF) are significant and positive suggesting investor react more to per unit of growth in growth firm. Panel B provides consistent evidence for the growth sequence, it shows that market reacts to more to per unit of asset growth as the growth sequence increases.

Overall, the findings in Table 8 provide additional confirmation that asset growth effect is indeed driven by investors overreaction to growth information during the formation period. Although the lifecycle proxies may potentially correlate with the proxies of investment frictions (used for testing q-theory explanation), the evidence of price movement during the formation period confirms that the moderation effect of growth types are indeed capturing the variation in investors’ overreactions to growth. This provides further evidence to differentiate our explanation from the q-theory explanations.

7. Conclusions

This paper extends the search for an explanation of the asset growth anomaly. Previous studies document evidence that firms with high limits-to-arbitrage and high investment frictions have a stronger asset growth anomaly. In this paper, we show that growth firms have a stronger asset growth anomaly than mature firms and the result is robust to both sorting and regression methodologies. Furthermore, we show that the firm growth phase provides additional information over and above limits-to-arbitrage and investment frictions in terms of explaining the asset growth anomaly.

We then show that the way investors react to firm asset growth is consistent with overreaction underpinned by representativeness. When investors see a series of asset growth surprises, they tend to overreact to firm asset growth and investors overreact more when the strength of the sequence increases. Hence, the evidence presented here supports overreaction as the potential source of the asset growth anomaly and this being underpinned by the representativeness heuristic.

In summary, we show that growth firms have a greater tendency to display the asset growth anomaly over and above limits-to-arbitrage and investment frictions, and furthermore, this effect seems to be explained by investor overreaction that is underpinned by the representativeness heuristic. This evidence complements and extends the initial analysis of the mispricing hypothesis by Cooper et al. (2008).

Appendix A. Definition of variables

**Asset growth (AG)** is calculated by the equation: AGt = (Assett-1-Assett-2)/Assett-2.

**Book-to-market ratio (BM)** is the book value of assets in year t-1 divided by market value at the end of year t-1. Book value is total assets minus liabilities, plus balance sheet deferred taxes and investment tax credits, minus preferred stock liquidation value if available, or redemption value if available, or carrying value if available (e.g., Fama and French, 1993).

**Market value (MV)** is the market capitalization at the end of June in year t, measured as $ Million. Market capitalization is price multiplied by outstanding shares.

**Previous six-month return (Pre6ret)** is past six-month compounding returns ending at the end of June in year t.

**Retained earnings (RE)** is the retained earnings in the previous fiscal year divided by total assets in previous fiscal year.

**Dividend (DIV)** is a total dividend if available divided by income before extra items at the previous fiscal year.

**Cash flow (CF)** is cash flow scaled by total assets in the previous fiscal year. Cash flow is operating income after depreciation minus accruals. Accruals are the change of non-cash current assets minus the change of current liabilities and depreciation.

**Analyst coverage (COV)** is the number of analysts following the firm at the end of June in each year.

**Dispersion in analysts forecast (DISP)** is the standard deviation of analyst forecast for earnings per share at the end of June in year t scaled stock price at the end of June in year t-1.

**Bid-ask spread (BAS)** is time series average of over past 12 months ending at the end of June in year t (e.g., Lam and Wei, 2011).

**Idiosyncratic volatility (IVOL)** is the standard deviation of the residual from the regression of stock return on the market return over the past 12 months ending at the end of June in year t (requires a 36-month history and a minimum of 24 months to estimate the regression if 36-months of data is not available).

**Dollar trading volume (DVOL)** is the time series average of the past 12-month dollar trading volume that is the closing price multiplied by monthly traded shares ending at the end of June in year t. If there is no past 12-month information, we require at least 6-month data. It is measured in millions of dollars.

**Firm’s total assets (ASSET)** is the book value of total assets in the previous fiscal year.

**Firm age (AGE)** is the number of years a stock appeared in CRSP database at the end of June in year t.

References

Ali, A., L. Hwang and M. A. Trombley, 2003, Arbitrage risk and the book-to-market anomaly, *Journal of Financial Economics* 69, 355-373.

Alti, A. and P. Tetlock, 2014, Biased beliefs, asset prices, and investment: a structural approach, *Journal of Finance* 69, 325-361.

Anthony, J. H. and K. Ramesh, 1992, Association between accounting performance measures and stock prices: a test of the life cycle hypothesis, *Journal of Accounting and Economics* 15, 203-227.

Banz, R. W. and W. J. Breen, 1986, Sample-dependent results using accounting and market data: some evidence, *Journal of Finance* 41, 779-793.

Barberis, N., A. Shleifer and R. Vishny, 1998, A model of investor sentiment, *Journal of Financial Economics* 49, 307-343.

Barron, O. and P. Stuerke, 1998, Dispersion in analyst’s earnings forecasts as a measure of uncertainty, *Journal of Accounting, Auditing, and Finance* 13, 243-268.

Barry, C. B. and S. J. Brown, 1985, Differential information and security market equilibrium, *Journal of Financial and Quantitative Analysis* 20, 407-422.

Buehler, R., D. Griffin and M. Ross, 1994, Exploring the planning fallacy: why people underestimate their task completion times, *Journal of Personality and Social Psychology* 67, 366−381.

Bulan, L., N. Subramanian and L. Tanlu, 2007, On the timing of dividend initiations, *Financial Management* 36, 31-65.

Chen, L. and L. Zhang, 2010, A better three-factor model that explains more anomalies, *Journal of Finance* 65, 563-595.

Cochrane, J., 1991, Production-based asset pricing and the link between stock returns and economic fluctuations, *Journal of Finance* 46, 209-237.

Cochrane, J., 1996, A cross-sectional test of an investment-based asset pricing model, *Journal of Political Economy* 104, 572-621.

Cooper, M. J., H. Gulen and M. J. Schill, 2008, Asset growth and the cross-section of stock returns, *Journal of Finance* 63, 1609-1649.

DeAngelo, H., L. DeAngelo and R. M. Stulz, 2006, Dividend policy and the earned/contributed capital mix: a test of the life-cycle theory, *Journal of Financial Economics* 81, 227-254.

DeAngelo, H., L. DeAngelo and R. M. Stulz, 2010, Seasoned equity offerings, market timing, and the corporate lifecycle, Journal of Financial Economics 95, 275-295.

Dickinson, V., 2011, Cash flow patterns as a proxy for firm life cycle, *The Accounting Review* 86, 1969-1994.

Diether, K. B., C. J. Malloy and A. Scherbina, 2002, Difference of opinion and the cross section of stock returns, *Journal of Finance* 57, 2113-2141.

Dong, M, D. Hirshleifer and S. H. Teoh, 2012, Overvalued equity and financing decisions, *Review of Financial Studies* 25, 3645-3683.

Fama, E. F. and K. R. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3-56.

Fama, E. F. and K. R. French, 2008, Dissecting anomalies, *Journal of Finance* 63, 1653-1678.

Fama, E. F. and J. D. MacBeth, 1973, Risk, return and equilibrium: empirical tests, *Journal of Political Economy* 81, 607-636.

Hirsch, J. and U. Walz, 2011, Financing decisions along a firm’s life-cycle: debt as a commitment device, *European Financial Management* 17, 898-927.

Hong, H. and J. C. Stein, 1999, A unified theory of underreaction, momentum trading, and overreaction in asset markets, *Journal of Finance* 54, 2143-2184.

Hong, H., T. Lim and J. C. Stein, 2000, Bad news travels slowly: size, analyst coverage, and the profitability of momentum strategies*, Journal of Finance* 55, 265-295.

Hribar, P. and N. Yehuda, 2015, The mispricing of cash flows and accruals at different life-cycle stages, *Contemporary Accounting Research* 32, 1053–1072.

Lakonishok, J. and T. Vermaelen, 1990, Anomalous price behavior around repurchase tender offer, *Journal of Finance* 45, 455-477.

Lakonishok, J. A.Shleifer and R. Vishny, 1994, Contrarian investment, extrapolation, and risk, *Journal of Finance* 49, 1541-78.

Lam, F. Y. and K. C. Wei, 2011, Limits-to-arbitrage, investment frictions, and the asset growth anomaly, *Journal of Financial Economics* 102, 127-149.

Li, X. N., D. Livdan and L. Zhang, 2009, Anomalies, *Review of Financial Studies* 22, 4301-4334.

Li, D. M. and L. Zhang, 2010, Does q-theory with investment frictions explain anomalies in the cross section of returns?, *Journal of Financial Economics* 98, 297-314.

Lipson, M. L., S. Mortal, and M. J. Schill, 2011, On the scope and drivers of the asset growth effect, *Journal of Financial and Quantitative Analysis* 46, 1651-1682.

Loughran, T. and J. Ritter, 1995, The new issues puzzles, *Journal of Finance* 50, 23-52.

Newey, W. K. and K. D. West, 1987, A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix, *Econometrica* 55, 703-708.

Pontiff, J., 1996, Costly arbitrage: evidence from closed-end funds, *Quarterly Journal of Economics* 111, 1135-1152.

Schwert, G.W., 2003, Anomalies and market efficiency, Chapter 15 in the *Handbook of the Economics of Finance*, eds. Constantinides, G., M. Harris and R.M. Stulz, North Holland.

Titman, S., K. C. J. Wei and F. Xie, 2013, Market Development and the Asset Growth Effect: International Evidence, *Journal of Financial and Quantitative Analysis* 48, 1405-1432.

Tversky, A. and D. Kahneman, 1974, Judgment under uncertainty: heuristics and bias, *Science* 185, 1124-1131.

Watanabe, A., Y. Xu, T. Yao and T. Yu, 2013, The asset growth effect: insights from international equity markets, *Journal of Financial Economics* 108, 529-563.

Weinstein, N., 1980, Unrealistic optimism about future life events, *Journal of Personality and Social Psychology* 39, 806-820.

Wurgler, J. and E. Zhuravskaya, 2002, Does arbitrage flatten demand curves for stocks?, *Journal of Business* 75, 583-608.

Zhang, X. F., 2006, Information uncertainty and stock returns, *Journal of Finance* 61, 105-137.

Table 1. Descriptive statistics and correlations

Panel A reports the mean of firm characteristics. All firms are divided into growth firms and mature firms based on three growth type proxies--retained earnings divided by total assets (RE), ), dividends scaled by earnings before extraordinary items (DIV), and cash flow scaled by total assets (CF). Differences between growth firms and mature firms with t statistics are reported. \*, \*\*, and \*\*\* indicate the significance level at 0.10, 0.05 and 0.01. Panel B reports Pearson correlations below the diagonal and Spearman rank-order correlations above the diagonal for limits-to-arbitrage and investment friction proxies. The definitions of these proxies are in appendix A.

Panel A. Descriptive statistics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   | RE |  | DIV |  | CF |
|   | Growth | Mature | dif(G-M) | t(G-M) |  | Growth | Mature | dif(G-M) | t(G-M) |  | Growth | Mature | dif(G-M) | t(G-M) |
| ASSET | 287 | 2109 | -1822\*\*\* | -42.30 |  | 920 | 4519 | -3599\*\*\* | -21.28 |  | 188 | 4423 | -4234\*\*\* | -69.49 |
| AGE | 7.83 | 14.95 | -7.12\*\*\* | 126.28 |  | 8.55 | 15.96 | -7.42\*\*\* | -95.23 |  | 7.82 | 15.42 | -7.59\*\*\* | 125.50 |
| BAS | 0.04 | 0.02 | 0.02\*\*\* | 73.71 |  | 0.03 | 0.01 | 0.02\*\*\* | 64.94 |  | 0.04 | 0.01 | 0.03\*\*\* | 95.09 |
| COV | 80.74 | 100.68 | -19.94\*\*\* | -11.04 |  | 68.47 | 95.47 | -27.00\*\*\* | -11.18 |  | 67.51 | 126.75 | -59.24\*\*\* | -30.27 |
| DISP | 105.90 | 23.09 | 82.77\*\* | 2.53 |  | 155.70 | 34.23 | 121.43\*\*\* | 2.60 |  | 84.46 | 39.73 | 44.74 | 1.48 |
| DVOL | 0.48 | 3.19 | -2.71\*\*\* | -27.83 |  | 0.81 | 3.15 | -2.34\*\*\* | -18.90 |  | 0.48 | 4.94 | -4.46\*\*\* | -38.65 |
| IVOL | 0.21 | 0.10 | 0.10\*\*\* | 174.33 |  | 0.17 | 0.09 | 0.08\*\*\* | 158.06 |  | 0.20 | 0.09 | 0.11\*\*\* | 187.44 |

**Panel B. Correlations**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|   | IVOL | BAS | COV | DISP | DVOL | AGE | ASSET |
| IVOL | 1 | 0.479 | -0.084 | 0.190 | -0.233 | -0.309 | -0.513 |
| BAS | 0.340 | 1 | -0.725 | -0.441 | -0.750 | -0.302 | -0.711 |
| COV | -0.094 | -0.326 | 1 | 0.633 | 0.777 | 0.187 | 0.521 |
| DSIP | 0.009 | 0.011 | 0.010 | 1 | 0.462 | 0.055 | 0.296 |
| DVOL | -0.189 | -0.513 | 0.607 | 0.006 | 1 | 0.193 | 0.730 |
| AGE | -0.243 | -0.188 | 0.199 | 0.003 | 0.278 | 1 | 0.370 |
| ASSET | -0.427 | -0.460 | 0.407 | 0.006 | 0.734 | 0.420 | 1 |

**Table 2. The asset growth effect in growth and mature firms**

This table reports average monthly returns and Fama-French alphas for each asset growth group over one year for both growth and mature firms (returns are in %). Firms are divided into deciles based on growth type proxies including retained earnings scaled by total assets (RE), dividends scaled by earnings before extraordinary items (DIV), and cash flow scaled by total assets (CF). The top 3 deciles and bottom 3 deciles are considered as mature and growth firms respectively for RE, DIV and CF. Within mature and growth firms, firms are further divided into deciles based on the asset growth rate. For each asset growth decile, stocks are held for one year from July in year t to June in year t+1. The table reports average returns or alphas over the period; and the spread is the difference between the low asset growth group and the high asset growth group. The table also reports the average of the hedge difference between growth and mature firms given each growth stage proxy; hedge returns are calculated as the return of the low asset growth group minus the return of the high asset growth group. Panel A reports equal-weighted portfolio average monthly raw returns. Panel B reports value-weighted portfolio average monthly raw returns. Panel C reports equal-weighted portfolio Fama-French monthly alphas. Panel D reports value-weighted portfolio Fama-French monthly alphas. The sample period is from 1963 to 2011; t-values in parentheses are based on Newey-West (1987) standard errors correcting for heteroscedasticity and autocorrelation; \*, \*\*, and \*\*\* indicate the significance level at 0.10, 0.05 and 0.01.

**Table 2. Continued**

Panel A: Equal-weighted portfolio average monthly raw returns

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Proxy | Growth type | 1(Low) | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10(High) | Diff(1-10) | t | Firm-year obs |
| RE | Mature | 1.6 | 1.5 | 1.4 | 1.4 | 1.3 | 1.4 | 1.4 | 1.3 | 1.1 | 1.0 | 0.6\*\*\* | 3.89 | 59855 |
|  | Growth | 2.1 | 2.0 | 1.8 | 1.8 | 1.5 | 1.4 | 1.2 | 0.7 | 0.7 | 0.0 | 2.0\*\*\* | 7.69 | 59852 |
|  | Spread (G-M) |  |  |  |  |  |  |  |  |  |  | 1.5\*\*\* | 5.78 |  |
| DIV | Mature | 1.5 | 1.4 | 1.4 | 1.2 | 1.3 | 1.2 | 1.2 | 1.1 | 1.0 | 0.9 | 0.7\*\*\* | 5.06 | 25272 |
|  | Growth | 1.8 | 1.6 | 1.7 | 1.4 | 1.4 | 1.3 | 1.4 | 1.1 | 1.0 | 0.8 | 1.0\*\*\* | 5.82 | 25267 |
|  | Spread (G-M) |  |  |  |  |  |  |  |  |  |  | 1.0\*\*\* | 3.06 |  |
| CF | Mature | 1.6 | 1.4 | 1.4 | 1.4 | 1.2 | 1.2 | 1.2 | 1.2 | 1.1 | 0.8 | 0.8\*\*\* | 4.94 | 57967 |
|  | Growth | 2.1 | 2.0 | 2.0 | 1.6 | 1.4 | 1.3 | 1.0 | 0.6 | 0.4 | -0.1 | 2.1\*\*\* | 7.95 | 57963 |
|   | Spread (G-M) |  |  |  |  |  |  |  |  |  |  | 1.3\*\*\* | 5.11 |  |

Panel B: Value-weighted portfolio average monthly raw returns

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Proxy | Growth type | 1(Low) | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10(High) | Diff(1-10) | t |
| RE | Mature | 1.8 | 1.7 | 1.4 | 1.4 | 1.4 | 1.3 | 1.5 | 1.5 | 1.6 | 1.8 | -0.1 | -0.27 |
|  | Growth | 4.3 | 3.5 | 3.4 | 2.9 | 2.0 | 2.3 | 2.4 | 2.3 | 2.5 | 2.5 | 1.9\*\*\* | 5.01 |
|  | Spread (G-M) |  |  |  |  |  |  |  |  |  |  | 1.9\*\*\* | 5.13 |
| DIV | Mature | 1.6 | 1.5 | 1.4 | 1.3 | 1.2 | 1.2 | 1.2 | 1.1 | 1.3 | 1.2 | 0.3 | 1.51 |
|  | Growth | 2.3 | 1.7 | 1.8 | 1.6 | 1.9 | 1.6 | 1.9 | 1.7 | 1.6 | 1.9 | 0.4 | 1.56 |
|  | Spread (G-M) |  |  |  |  |  |  |  |  |  |  | 0.1 | 0.39 |
| CF | Mature | 1.9 | 1.7 | 1.4 | 1.4 | 1.3 | 1.3 | 1.5 | 1.5 | 1.5 | 1.6 | 0.3 | 1.55 |
|  | Growth | 4.2 | 3.8 | 3.7 | 3.1 | 2.8 | 2.8 | 2.9 | 2.5 | 2.6 | 2.5 | 1.7\*\*\* | 4.22 |
|  | Spread (G-M) |  |  |  |  |  |  |  |  |  |  | 1.3\*\*\* | 3.40 |

**Table 2. Continued**

Panel C: Equal-weighted portfolio Fama-French monthly alphas

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Proxy | Growth type | 1(Low) | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10(High) | Diff(1-10) | t |
| RE | Mature | 0.7 | 0.5 | 0.6 | 0.7 | 0.5 | 0.6 | 0.5 | 0.5 | 0.3 | 0.3 | 0.4\*\* | 2.11 |
|  | Growth | 0.7 | 0.4 | 0.5 | 0.5 | 0.3 | 0.2 | 0.0 | -0.6 | -0.4 | -1.1 | 1.8\*\*\* | 5.74 |
|  | Spread (G-M) |  |  |  |  |  |  |  |  |  |  | 1.4\*\*\* | 4.03 |
| DIV | Mature | 0.4 | 0.5 | 0.5 | 0.3 | 0.5 | 0.4 | 0.3 | 0.3 | 0.3 | -0.1 | 0.5\*\*\* | 3.04 |
|  | Growth | 0.8 | 0.6 | 0.8 | 0.3 | 0.5 | 0.3 | 0.4 | 0.2 | 0.0 | -0.4 | 1.1\*\*\* | 5.66 |
|  | Spread (G-M) |  |  |  |  |  |  |  |  |  |  | 0.6\*\* | 2.47 |
| CF | Mature | 0.5 | 0.5 | 0.6 | 0.5 | 0.4 | 0.5 | 0.5 | 0.4 | 0.4 | 0.0 | 0.5\*\*\* | 2.81 |
|  | Growth | 0.5 | 0.7 | 0.6 | 0.4 | 0.4 | 0.2 | 0.0 | -0.5 | -0.6 | -1.0 | 1.6\*\*\* | 4.67 |
|  | Spread (G-M) |  |  |  |  |  |  |  |  |  |  | 1.1\*\*\* | 3.86 |

Panel D: Value-weighted portfolio Fama-French monthly alphas

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Proxy | Growth type | 1(Low) | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10(High) | Diff(1-10) | t |
| RE | Mature | 1.0 | 0.9 | 0.8 | 0.7 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 1.2 | -0.2 | -0.77 |
|  | Growth | 3.0 | 2.3 | 2.2 | 1.9 | 1.3 | 1.6 | 1.4 | 1.4 | 1.4 | 1.4 | 1.6\*\*\* | 3.45 |
|  | Spread (G-M) |  |  |  |  |  |  |  |  |  |  | 1.8\*\*\* | 3.71 |
| DIV | Mature | 0.8 | 0.9 | 0.6 | 0.6 | 0.6 | 0.5 | 0.5 | 0.5 | 1.0 | 0.5 | 0.3 | 1.12 |
|  | Growth | 1.4 | 1.1 | 1.2 | 1.0 | 1.4 | 0.7 | 1.2 | 1.0 | 1.0 | 0.9 | 0.5\* | 1.88 |
|  | Spread (G-M) |  |  |  |  |  |  |  |  |  |  | 0.2 | 0.60 |
| CF | Mature | 1.0 | 1.0 | 0.8 | 0.7 | 0.7 | 0.7 | 0.9 | 0.8 | 0.8 | 0.9 | 0.1 | 0.43 |
|  | Growth | 2.9 | 2.9 | 2.6 | 2.1 | 1.8 | 1.9 | 2.1 | 1.6 | 1.5 | 1.6 | 1.2\*\*\* | 2.91 |
|  | Spread (G-M) |  |  |  |  |  |  |  |  |  |  | 1.2\*\*\* | 2.86 |

**Table 3. Growth type and the asset growth anomaly**

This table reports the time-series average of estimated coefficients of monthly regressions from 1963 to 2011. In each month we run the following regression:

 *Eq(1)*

Where Reti is the monthly raw return; AG is firm asset growth; GT indicates a firm’s growth type (GT=1 if growth firm and GT=0 if mature firm). Firms are divided into deciles based on the growth type proxies including retained earnings scaled by total assets (RE), dividends scaled by earnings before extraordinary items (DIV) and cash flow scaled by total assets (CF). The top 3 deciles and bottom 3 deciles are considered as mature and growth firms respectively for RE, DIV and CF. Control variables are the natural logarithm of market capitalization (lnMV), the natural logarithm of the book-to-market ratio (lnBM) and previous 6-month returns at the end of June. The t-values in parentheses are based on Newey-West (1987) standard errors for correcting heteroscedasticity and autocorrelation; \*, \*\*, and \*\*\* indicate the significance level at 0.10, 0.05 and 0.01.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   | RE |   | DIV |   | CF |
| Intercept | 2.07\*\*\* |  | 1.60\*\*\* |  | 2.49\*\*\* |
|  | (6.80) |  | (6.30) |  | (7.47) |
| ln(1+AG) | -0.21 |  | -0.66\*\*\* |  | -0.59\*\*\* |
|  | (-0.78) |  | (-2.79) |  | (-2.98) |
| ln(1+AG)\*GT | -1.12\*\*\* |  | -0.78\*\* |  | -0.94\*\*\* |
|  | (-3.53) |  | (-2.52) |  | (-3.46) |
| GT | -0.07 |  | 0.23\*\* |  | -0.34\*\* |
|  | (-0.49) |  | (2.33) |  | (-2.16) |
| lnBM | 0.18\*\*\* |  | 0.07\* |  | 0.08\*\* |
|  | (3.90) |  | (1.82) |  | (1.97) |
| lnMV | -0.14\*\*\* |  | -0.09\*\*\* |  | -0.19\*\*\* |
|  | (-3.79) |  | (-2.74) |  | (-5.47) |
| Pre6ret | 0.16 |  | 0.63\*\*\* |  | 0.26 |
|   | (0.87) |   | (3.11) |   | (1.50) |

**Table 4. Growth type, limits-to-arbitrage, investment frictions and the asset growth anomaly**

This table reports the time-series average of estimated coefficients of monthly regressions from 1963 to 2011. In each month we run the following regression:

*Eq(2)*

Where Reti is the monthly raw return; AG is firm asset growth; GT indicates a firm’s growth type (GT=1 if growth firm, GT=0 for mature firm). Firms are divided into deciles based on the growth type proxies including retained earnings scaled by total assets (RE), dividends scaled by earnings before extraordinary items (DIV) and cash flow scaled by total assets (CF) in Panels A, B and C, respectively. The top 3 deciles and bottom 3 deciles are considered as mature and growth firms. LIproxy is a proxy of the limit-to-arbitrage or investment frictions Models 1 to 5 reports the interactive effect of growth type and asset growth by controlling for limits-to-arbitrage proxies -- idiosyncratic volatility (IVOL), bid-ask spread (BAS), analyst forecast (COV), forecast dispersion among analysts (DISP) and dollar trading volume (DVOL) respectively. Models 6 and 7 report the interactive effect of growth type and asset growth by controlling for investment friction proxies – firm age (AGE) and firm total assets (ASSET). Control variables are the natural logarithm of market capitalization (lnMV), the natural logarithm of the book-to-market ratio (lnBM) and the previous 6-month returns at the end of June (Pre6ret). The t-values in parentheses are based on Newey-West (1987) standard errors for correcting heteroscedasticity and autocorrelation; \*, \*\*, and \*\*\* indicate the significance level at 0.10, 0.05 and 0.01.

Panel A: growth type proxy – RE

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|   | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 |
| Intercept | 1.95\*\*\* | 1.01\*\* | 2.20\*\*\* | 2.15\*\*\* | 1.54\* | 2.07\*\*\* | 2.10\*\*\* |
|  | (8.70) | (2.33) | (5.08) | (5.40) | (1.89) | (5.80) | (6.58) |
| ln(1+AG) | 0.32 | -0.20 | -0.86\*\* | 0.05 | 0.15 | -0.54 | -1.38\*\* |
|  | (0.83) | (-0.50) | (-2.57) | (0.16) | (0.32) | (-0.91) | (-2.30) |
| ln(1+AG)\*GT | -0.63\* | -1.34\*\*\* | -0.80 | -1.14\*\* | -0.79\*\* | -1.00\*\*\* | -0.73\*\* |
|  | (-1.69) | (-2.86) | (-1.47) | (-2.05) | (-2.40) | (-2.95) | (-2.22) |
| ln(1+AG)\*IVOL | -5.20 |  |  |  |  |  |  |
|  | (-1.56) |  |  |  |  |  |  |
| ln(1+AG)\*BAS |  | 10.45 |  |  |  |  |  |
|  |  | (-0.82) |  |  |  |  |  |
| ln(1+AG)\*COV |  |  | 0.02 |  |  |  |  |
|  |  |  | (1.04) |  |  |  |  |
| ln(1+AG)\*DISP |  |  |  | -10.25 |  |  |  |
|  |  |  |  | (-0.91) |  |  |  |
| ln(1+AG)\*DVOL |  |  |  |  | 0.14 |  |  |
|  |  |  |  |  | (1.43) |  |  |
| ln(1+AG)\*AGE |  |  |  |  |  | 0.01 |  |
|  |  |  |  |  |  | (0.07) |  |
| ln(1+AG)\*ASSET |  |  |  |  |  |  | 0.23\*\* |
|  |  |  |  |  |  |  | (2.15) |
| GT | -0.13 | -0.07 | 0.00 | 0.12 | -0.08 | -0.09 | -0.13 |
|  | (-1.10) | (-0.30) | (0.01) | -0.53 | (-0.58) | (-0.60) | (-0.83) |
| IVOL | 1.61 |  |  |  |  |  |  |
|  | (1.07) |  |  |  |  |  |  |
| BAS |  | 8.09 |  |  |  |  |  |
|  |  | (1.30) |  |  |  |  |  |
| COV |  |  | 0.00 |  |  |  |  |
|  |  |  | (0.58) |  |  |  |  |
| DISP |  |  |  | -5.07\*\* |  |  |  |
|  |  |  |  | (-2.35) |  |  |  |
| DVOL |  |  |  |  | -0.06 |  |  |
|  |  |  |  |  | (-0.80) |  |  |
| AGE |  |  |  |  |  | 0.01 |  |
|  |  |  |  |  |  | (0.16) |  |
| ASSET |  |  |  |  |  |  | 0.09 |
|  |  |  |  |  |  |  | (1.11) |
| lnBM | 0.17\*\*\* | 0.20\*\*\* | 0.12\* | 0.16\*\* | 0.18\*\*\* | 0.17\*\*\* | 0.08 |
|  | (4.04) | (2.74) | (1.80) | (2.32) | (4.26) | (3.99) | (1.19) |
| lnMV | -0.13\*\*\* | 0.04 | -0.15\*\*\* | -0.12\*\*\* | -0.07 | -0.14\*\*\* | -0.24\*\*\* |
|  | (-4.15) | (0.78) | (-2.69) | (-2.71) | (-0.82) | (-3.80) | (-3.08) |
| Pre6ret | 0.10 | 0.08 | 0.09 | 0.06 | 0.27 | 0.16 | 0.22 |
|   | (0.59) | (0.46) | (0.50) | (0.33) | (1.60) | (0.90) | (1.20) |

Panel B: growth type proxy – DIV

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|   | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 |
| Intercept | 1.48\*\*\* | 1.25\*\*\* | 1.65\*\*\* | 1.57\*\*\* | 0.97 | 1.52\*\*\* | 1.70\*\*\* |
|  | (7.66) | (3.23) | (4.39) | (4.61) | (1.35) | (5.32) | (6.60) |
| ln(1+AG) | 0.07 | 0.04 | -0.46 | 0.00 | 0.32 | -1.25\* | -1.91\*\*\* |
|  | (0.18) | (0.08) | (-1.27) | (0.01) | (0.84) | (-1.68) | (-3.35) |
| ln(1+AG)\*GT | -0.31 | -1.07\* | -0.45 | -0.66 | -1.01\*\*\* | -0.63\*\* | -0.79\*\* |
|  | (-0.88) | (-1.95) | (-0.99) | (-1.34) | (-3.26) | (-2.00) | (-2.54) |
| ln(1+AG)\*IVOL | -10.10\*\* |  |  |  |  |  |  |
|  | (-2.00) |  |  |  |  |  |  |
| ln(1+AG)\*BAS |  | -48.72 |  |  |  |  |  |
|  |  | (-1.61) |  |  |  |  |  |
| ln(1+AG)\*COV |  |  | -0.00 |  |  |  |  |
|  |  |  | (-0.24) |  |  |  |  |
| ln(1+AG)\*DISP |  |  |  | -12.26 |  |  |  |
|  |  |  |  | (-1.25) |  |  |  |
| ln(1+AG)\*DVOL |  |  |  |  | 0.24\*\*\* |  |  |
|  |  |  |  |  | (2.76) |  |  |
| ln(1+AG)\*AGE |  |  |  |  |  | 0.05 |  |
|  |  |  |  |  |  | (0.28) |  |
| ln(1+AG)\*ASSET |  |  |  |  |  |  | 0.24\*\* |
|  |  |  |  |  |  |  | (2.57) |
| GT | 0.18\*\* | 0.32\*\* | 0.30\*\*\* | 0.35\*\*\* | 0.27\*\*\* | 0.22\*\* | 0.24\*\* |
|  | (2.07) | (2.39) | (2.70) | (3.02) | (3.07) | (2.24) | (2.47) |
| IVOL | 1.55 |  |  |  |  |  |  |
|  | (0.85) |  |  |  |  |  |  |
| BAS |  | 2.00 |  |  |  |  |  |
|  |  | (0.23) |  |  |  |  |  |
| COV |  |  | 0.00 |  |  |  |  |
|  |  |  | (0.75) |  |  |  |  |
| DISP |  |  |  | -1.62 |  |  |  |
|  |  |  |  | (-0.97) |  |  |  |
| DVOL |  |  |  |  | -0.08 |  |  |
|  |  |  |  |  | (-1.30) |  |  |
| AGE |  |  |  |  |  | 0.02 |  |
|  |  |  |  |  |  | (0.72) |  |
| ASSET |  |  |  |  |  |  | -0.01 |
|  |  |  |  |  |  |  | (-0.22) |
| lnBM | 0.06\* | 0.00 | 0.02 | 0.09\* | 0.08\*\* | 0.06 | 0.04 |
|  | (1.78) | (0.01) | (0.39) | (1.65) | (2.08) | (1.60) | (0.79) |
| lnMV | -0.08\*\*\* | -0.05 | -0.09\* | -0.07\* | -0.01 | -0.10\*\*\* | -0.09 |
|  | (-2.91) | (-0.92) | (-1.86) | (-1.74) | (-0.16) | (-3.12) | (-1.37) |
| Pre6ret | 0.64\*\*\* | 0.79\*\*\* | 0.53\*\* | 0.48\*\* | 0.69\*\*\* | 0.64\*\*\* | 0.63\*\*\* |
|   | (3.27) | (3.18) | (2.38) | (2.05) | (3.48) | (3.12) | (3.09) |

Panel C: growth type proxy – CF

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|   | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 |
| Intercept | 2.43\*\*\* | 1.78\*\*\* | 2.34\*\*\* | 2.26\*\*\* | 1.77\*\* | 2.33\*\*\* | 2.66\*\*\* |
|  | (9.34) | (3.39) | (4.76) | (5.10) | (2.16) | (6.44) | (7.93) |
| ln(1+AG) | -0.42 | -0.62\* | -0.69\*\* | -0.22 | -0.25 | -0.80 | -2.43\*\*\* |
|  | (-1.29) | (-1.76) | (-2.40) | (-0.79) | (-0.82) | (-1.48) | (-3.49) |
| ln(1+AG)\*GT | -0.80\*\*\* | -0.70 | -0.29 | -0.41 | 0.01 | -0.83\*\*\* | -0.02 |
|  | (-2.59) | (-1.50) | (-0.71) | (-0.88) | (0.04) | (-2.93) | (-0.05) |
| ln(1+AG)\*IVOL | -2.10 |  |  |  |  |  |  |
|  | (-0.71) |  |  |  |  |  |  |
| ln(1+AG)\*BAS |  | -7.78 |  |  |  |  |  |
|  |  | (-0.38) |  |  |  |  |  |
| ln(1+AG)\*COV |  |  | 0.01 |  |  |  |  |
|  |  |  | (0.62) |  |  |  |  |
| ln(1+AG)\*DISP |  |  |  | -19.26\*\* |  |  |  |
|  |  |  |  | (-2.04) |  |  |  |
| ln(1+AG)\*DVOL |  |  |  |  | 0.27\*\*\* |  |  |
|  |  |  |  |  | (2.94) |  |  |
| ln(1+AG)\*AGE |  |  |  |  |  | -0.04 |  |
|  |  |  |  |  |  | (-0.39) |  |
| ln(1+AG)\*ASSET |  |  |  |  |  |  | 0.29\*\*\* |
|  |  |  |  |  |  |  | (2.69) |
| GT | -0.37\*\*\* | -0.71\*\*\* | -0.44\*\* | -0.37\* | -0.42\*\*\* | -0.33\*\* | -0.43\*\*\* |
|  | (-2.77) | (-2.93) | (-2.20) | (-1.72) | (-2.90) | (-2.16) | (-2.82) |
| IVOL | 0.58 |  |  |  |  |  |  |
|  | (0.42) |  |  |  |  |  |  |
| BAS |  | 13.46\* |  |  |  |  |  |
|  |  | (1.95) |  |  |  |  |  |
| COV |  |  | 0.00 |  |  |  |  |
|  |  |  | (0.79) |  |  |  |  |
| DISP |  |  |  | -2.44 |  |  |  |
|  |  |  |  | (-1.29) |  |  |  |
| DVOL |  |  |  |  | -0.10 |  |  |
|  |  |  |  |  | (-1.27) |  |  |
| AGE |  |  |  |  |  | 0.06 |  |
|  |  |  |  |  |  | (1.33) |  |
| ASSET |  |  |  |  |  |  | -0.05 |
|  |  |  |  |  |  |  | (-0.76) |
| lnBM | 0.08\*\* | 0.03 | 0.04 | 0.05 | 0.07\* | 0.08\* | 0.10\* |
|  | (2.14) | (0.51) | (0.69) | (0.90) | (1.84) | (1.86) | (1.68) |
| lnMV | -0.19\*\*\* | -0.09 | -0.17\*\*\* | -0.14\*\*\* | -0.11 | -0.19\*\*\* | -0.17\*\* |
|  | (-6.05) | (-1.39) | (-2.95) | (-3.13) | (-1.24) | (-5.55) | (-2.35) |
| Pre6ret | 0.21 | 0.11 | 0.36\* | 0.35\* | 0.32\* | 0.26 | 0.24 |
|   | (1.21) | (0.56) | (1.77) | (1.67) | (1.88) | (1.48) | (1.44) |

**Table 5. Returns and the asset growth anomaly for growth sequence portfolios**

This table presents the average monthly raw returns (in %) and asset growth slopes within different growth sequences. We first sort firms into deciles; and define the top two deciles as high asset growth and the bottom two deciles as low asset growth. We then trace back firm asset growth to check in which year firms in high (low) decile at year t end their sequence. If firms in a high (low) decile stay in high (low) decile in year t-1 but do not locate in high (low) decile in year t-2, then such firms are grouped into H1 (L1). Similarly, according to the period of sequence, we construct H2 (L2), H3 (L3) and H4 (L4). Panel A reports the average monthly return in the 12 months after the formation period. Panel B reports the asset growth slop coefficients. Asset growth slopes are from the regression of monthly returns on asset growth, the natural logarithm of market value, the natural logarithm of the book-to-market ratio and previous six-month returns for portfolios including stocks in the H, L and both L and H sequence groups. The t-values are based on Newey-West (1987) standard errors for correcting heteroscedasticity and autocorrelation. Diff(4 – 1) reports the test for the difference between the statistics in Sequences 4 and 1. \*, \*\*, and \*\*\* indicate the significance level at 0.10, 0.05 and 0.01.

Panel A Hedge Returns

|  |  |  |  |
| --- | --- | --- | --- |
| Sequence | H | L | diff (L–H) |
| 1 | 0.86 | 1.70 | 0.83\*\*\* |
| 2 | 0.73 | 2.01 | 1.28\*\*\* |
| 3 | 0.36 | 1.78 | 1.42\*\*\* |
| 4 | 0.36 | 2.09 | 1.73\*\*\* |
|  |  |  |  |
| diff (4 – 1) | -0.50\*\*\* | 0.38\*\* | 0.90\*\*\* |

Panel B Asset Growth Slops

|  |  |  |  |
| --- | --- | --- | --- |
| Sequence | H | L | H&L |
| 1 | -1.18\*\*\* | 0.23 | -1.06\*\*\* |
| 2 | -0.77 | -2.02\* | -1.00\*\*\* |
| 3 | -3.65\*\* | -0.96 | -1.55\*\*\* |
| 4 | -7.94\* | -1.61 | -2.37\*\*\* |
|  |  |  |  |
| diff (4 – 1) | -6.76\* | -1.83 | -1.31\* |

**Table 6. Growth sequence, limits-to-arbitrage and investment frictions**

This table reports the time-series average of estimated coefficients of monthly regressions. In each month we run the following regression:

*Eq(3)*

Where Reti is the monthly raw return; AG is firm asset growth; high sequence indicates the length of high asset growth sequence and low sequence indicates the length of low asset growth sequence. LIproxy is a proxy of the limit-to-arbitrage or investment frictions Models 2 to 6 report the interactive effect of growth type and asset growth by controlling for limits-to-arbitrage proxies -- idiosyncratic volatility (IVOL), bid-ask spread (BAS), analyst forecast (COV), forecast dispersion among analysts (DISP) and dollar trading volume (DVOL) respectively. Models 7 and 8 report the interactive effect of growth type and asset growth by controlling for investment friction proxies – firm age (AGE) and firm total assets (ASSET). Control variables are the natural logarithm of market capitalization (lnMV), the natural logarithm of the book-to-market ratio (lnBM) and the previous 6-month returns at the end of June (Pre6ret). The t-values in parentheses are based on Newey-West (1987) standard errors for correcting heteroscedasticity and autocorrelation; \*, \*\*, and \*\*\* indicate the significance level at 0.10, 0.05 and 0.01.

**Table 6. Continued**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 |
| Intercept | 1.85\*\*\* | 1.76\*\*\* | 1.42\*\*\* | 2.05\*\*\* | 1.94\*\*\* | 1.85\*\*\* | 1.98\*\*\* | 1.94\*\*\* |
|  | (5.02) | (6.93) | (3.38) | (4.27) | (4.53) | (4.68) | (4.73) | (5.17) |
| ln(1+AG) | -0.79\*\*\* | 0.07 | -0.66\*\* | -0.67\*\* | 0.14 | -0.38 | -2.50\*\*\* | -2.07\*\*\* |
|  | (-3.79) | (0.24) | (-2.00) | (-2.31) | (0.42) | (-1.13) | (-4.24) | (-4.77) |
| ln(1+AG)\*High sequence | -0.25\*\* | -0.17 | -0.30\*\* | -0.25\* | -0.21 | -0.33\*\*\* | -0.18 | -0.26\*\* |
|  | (-2.22) | (-1.50) | (-1.99) | (-1.84) | (-1.46) | (-3.04) | (-1.58) | (-2.32) |
| ln(1+AG)\*Low sequence | -0.29 | -0.08 | 0.56 | -0.35 | -1.05 | -0.35 | -0.20 | -0.08 |
|  | (-1.00) | (-0.29) | (1.27) | (-0.68) | (-1.06) | (-1.20) | (-0.71) | (-0.27) |
| ln(1+AG)\*IVOL |  | -6.83\*\*\* |  |  |  |  |  |  |
|  |  | (-2.96) |  |  |  |  |  |  |
| ln(1+AG)\*BAS |  |  | -10.12 |  |  |  |  |  |
|  |  |  | (-1.07) |  |  |  |  |  |
| ln(1+AG)\*COV |  |  |  | 0.02\* |  |  |  |  |
|  |  |  |  | (1.70) |  |  |  |  |
| ln(1+AG)\*DISP |  |  |  |  | -28.93\*\*\* |  |  |  |
|  |  |  |  |  | (-3.12) |  |  |  |
| ln(1+AG)\*DVOL |  |  |  |  |  | 0.11 |  |  |
|  |  |  |  |  |  | (1.64) |  |  |
| ln(1+AG)\*AGE |  |  |  |  |  |  | 0.20\*\*\* |  |
|  |  |  |  |  |  |  | (2.63) |  |
| ln(1+AG)\*ASSET |  |  |  |  |  |  |  | 0.26\*\*\* |
|  |  |  |  |  |  |  |  | (3.44) |
| High sequence | -0.07 | -0.10\* | -0.03 | -0.07 | -0.08 | -0.08 | -0.09 | -0.07 |
|  | (-1.18) | (-1.94) | (-0.28) | (-1.22) | (-1.28) | (-1.34) | (-1.51) | (-1.12) |
| Low sequence | 0.04 | 0.06 | 0.07 | 0.05 | 0.09 | 0.05 | 0.04 | 0.06 |
|  | (0.72) | (1.14) | (0.74) | (0.79) | (1.29) | (0.86) | (0.82) | (1.18) |
| IVOL |  | 0.39 |  |  |  |  |  |  |
|  |  | (0.26) |  |  |  |  |  |  |
| BAS |  |  | 3.92 |  |  |  |  |  |
|  |  |  | (0.86) |  |  |  |  |  |
| COV |  |  |  | 0.00 |  |  |  |  |
|  |  |  |  | (0.39) |  |  |  |  |
| DISP |  |  |  |  | -0.77 |  |  |  |
|  |  |  |  |  | (-0.53) |  |  |  |
| DVOL |  |  |  |  |  | -0.29\*\* |  |  |
|  |  |  |  |  |  | (-2.08) |  |  |
| AGE |  |  |  |  |  |  | -0.01 |  |
|  |  |  |  |  |  |  | (-0.86) |  |
| ASSET |  |  |  |  |  |  |  | -0.01 |
|  |  |  |  |  |  |  |  | (-0.20) |
| lnBM | 0.15\*\*\* | 0.15\*\*\* | 0.13\*\* | 0.07 | 0.09 | 0.16\*\*\* | 0.15\*\*\* | 0.13\*\* |
|  | (3.10) | (3.46) | (2.00) | (1.27) | (1.54) | (3.41) | (3.17) | (2.32) |
| lnMV | -0.09\*\* | -0.09\*\*\* | -0.03 | -0.13\*\* | -0.10\*\* | -0.09\*\* | -0.09\*\* | -0.10 |
|  | (-2.41) | (-2.92) | (-0.72) | (-2.22) | (-2.31) | (-2.00) | (-2.37) | (-1.21) |
| Pre6ret | 0.09 | 0.08 | -0.08 | 0.20 | 0.22 | 0.10 | 0.09 | 0.09 |
|   | (0.62) | (0.56) | (-0.56) | (1.15) | (1.18) | (0.66) | (0.61) | (0.58) |

**Table 7 Asset Growth Effect by Growth Sequence with Control to Past Growth**

This table reports the asset growth effect regression by growth sequence with additional control of past growth. Asset growth slopes are from the regression of monthly returns on current and three lags of asset growth, the natural logarithm of market value, the natural logarithm of the book-to-market ratio and previous six-month returns. The regressions are done for portfolios including stocks in both L and H sequence groups. To form sequence groups, we first sort firms into deciles by asset growth; and define the top two deciles as high asset growth and the bottom two deciles as low asset growth. We then trace back firm asset growth identify how many sequences of growth at year t end. For example, if firms in a high (low) decile in year t and also in high (low) decile in year t-1 but do not locate in high (low) decile in year t-2, then such firms are grouped into H1 (L1). Similarly, according to the period of sequence, we construct H2 (L2), H3 (L3) and H4 (L4). The t-values are based on Newey-West (1987) standard errors for correcting heteroscedasticity and autocorrelation. \*, \*\*, and \*\*\* indicate the significance level at 0.10, 0.05 and 0.01.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|   | Sequence = 4 |   | Sequence = 3 |   | Sequence = 2 |   | Sequence = 1 |
|   | slope | t |   | slope | t |   | slope | t |   | slope | t |
| Intercept | 2.85\*\*\* | 3.58 |  | 2.42\*\*\* | 4.41 |  | 2.00\*\*\* | 4.60 |  | 1.95\*\*\* | 4.39 |
| ln(1+AG) | -1.74\* | -1.92 |  | -1.63\*\* | -2.38 |  | -0.87\*\*\* | -5.01 |  | -0.93\*\*\* | -4.91 |
| ln(1+AG)\_lag1 | 1.87 | 1.37 |  | 0.36 | 0.54 |  | -0.48\*\*\* | -2.89 |  | -0.59\* | -1.66 |
| ln(1+AG)\_lag2 | -2.09 | -1.00 |  | -0.05 | -0.08 |  | 0.03 | 0.13 |  | 0.13 | 0.50 |
| ln(1+AG)\_lag3 | -1.16 | -0.73 |  | 1.39\*\* | 2.20 |  | -0.13 | -0.67 |  | -0.50\*\* | -2.05 |
| lnBM | 0.19 | 0.78 |  | 0.26\* | 1.77 |  | 0.11\* | 1.72 |  | 0.08 | 1.08 |
| lnMV | -0.28\*\* | -2.06 |  | -0.20\*\* | -2.25 |  | -0.09\*\* | -2.10 |  | -0.09\* | -1.89 |
| pre6ret | -0.66 | -1.16 |   | -0.17 | -0.39 |   | 0.10 | 0.54 |   | 0.08 | 0.39 |

**Table 8 Asset Growth and Contemporary Return Relationship**

This table reports the time-series average of estimated coefficients of monthly regressions from 1963 to 2011. The dependent variable is the monthly raw return between t-18 to t-6 where t is the asset growth formation month (every June). AG is firm asset growth; Control variables are the natural logarithm of market capitalization (lnMV), the natural logarithm of the book-to-market ratio (lnBM) and previous 6-month returns at the end of June. Panel A reports the regression with growth type where GT indicates a firm’s growth type (GT=1 if growth firm and GT=0 if mature firm). Growth type classification is the same as discussed in Table 3. Panel B reports the regression with growth sequence and additional control of past growth up to 3 lags. Portfolio formations are the same as those defined in Table 7. The t-values are based on Newey-West (1987) standard errors for correcting heteroscedasticity and autocorrelation. \*, \*\*, and \*\*\* indicate the significance level at 0.10, 0.05 and 0.01.

**Panel A. the Effect of Growth Type**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   | RE |   | DIV |   | CF |
| Intercept | 1.34\*\*\* |  | 0.86\*\*\* |  | 1.33\*\*\* |
|  | (4.63) |  | (3.56) |  | (4.05) |
| ln(1+AG) | 3.30\*\*\* |  | 0.80\*\*\* |  | 1.89\*\*\* |
|  | (11.51) |  | (3.47) |  | (7.88) |
| ln(1+AG)\*GT | -0.33 |  | 1.62\*\*\* |  | 1.17\*\*\* |
|  | (-0.94) |  | (4.73) |  | (3.85) |
| GT | -0.53\*\*\* |  | 0.97\*\*\* |  | -0.64\*\*\* |
|  | (-3.18) |  | (8.41) |  | (-4.27) |
| lnBM | -1.07\*\*\* |  | -0.61\*\*\* |  | -0.91\*\*\* |
|  | (-20.68) |  | (-16.44) |  | (-19.46) |
| lnMV | -0.13\*\*\* |  | -0.05\* |  | -0.09\*\*\* |
|  | (-3.70) |  | (-1.79) |  | (-2.60) |
| Pre6ret | 1.45\*\*\* |  | 1.45\*\*\* |  | 1.44\*\*\* |
|   | (7.05) |   | (6.33) |   | (6.84) |

 Panel B. the Effect of Growth Sequence

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|   | Sequence=4 |   | Sequence=3 |   | Sequence=2 |   | Sequence=1 |
|   | slope | t |   | slope | t |   | slope | t |   | slope | t |
| Intercept | 3.35\*\*\* | 2.96 |  | 1.89\*\*\* | 3.41 |  | 1.18\*\*\* | 2.77 |  | 1.03\*\* | 2.29 |
| ln(1+AG) | 4.44\* | 1.88 |  | 3.39\*\*\* | 6.10 |  | 2.78\*\*\* | 13.48 |  | 2.74\*\*\* | 13.68 |
| ln(1+AG)\_lag1 | -1.71 | -0.92 |  | -2.55\*\*\* | -4.10 |  | -1.97\*\*\* | -10.05 |  | -2.23\*\*\* | -8.57 |
| ln(1+AG)\_lag2 | -1.58 | -0.65 |  | -1.45\*\* | -2.25 |  | -1.54\*\*\* | -6.68 |  | -1.48\*\*\* | -6.43 |
| ln(1+AG)\_lag3 | -2.13 | -0.69 |  | -0.01 | -0.02 |  | -0.34\* | -1.82 |  | -0.37\*\* | -2.00 |
| lnBM | -0.79 | -1.17 |  | -1.35\*\*\* | -7.82 |  | -1.20\*\*\* | -16.05 |  | -1.37\*\*\* | -15.82 |
| lnMV | -0.30\* | -1.68 |  | -0.11 | -1.37 |  | -0.01 | -0.24 |  | 0.00 | 0.02 |
| pre6ret | 0.97 | 0.44 |   | 0.99\*\* | 2.35 |   | 1.23\*\*\* | 6.61 |   | 1.20\*\*\* | 5.80 |

1. For events associated with expansion, Loughran and Ritter (1995) show that firms with equity issuance earn lower stock returns. For events associated with contraction, Lakonishok and Vermaelen (1990) show firms with share repurchase earn higher returns. [↑](#footnote-ref-1)
2. The rational explanation of the asset growth anomaly relies on the Q theory model that studies the investment-return relationship from a production-based asset pricing or firm optimal investment standpoint (e.g., Cochrane, 1991, 1996; Chen and Zhang, 2010; Li, Livdan and Zhang, 2009; Li and Zhang, 2010). The basic argument is that firms with low discount rates (expected returns) have high net present values and high investment, whereas firms with high discount rates have low net present values and low investment. Li and Zhang (2010) show that limits-to-arbitrage dominates Q theory in explaining the asset growth anomaly. Watanabe, Xu, Yao and Yu (2013) favor the optimal investment explanation by using global stock markets; they find that the asset growth anomaly is stronger in more advanced markets where stocks are more efficiently priced. Finally, Lam and Wei (2011) present evidence to support both limits-to-arbitrage and Q theory. [↑](#footnote-ref-2)
3. Firm life-cycle has been shows to be a useful dimension in understanding the cross-sectional variations of corporate finance decisions and accounting ratios. For example, Hirsch and Walz (2011) show that firm in different life-cycle patterns make different financing decisions and these decisions interaction with future growth and development decisions. Hribar and Yehuda (2015) study the mispricing of accrual and cash flow information by the stock market in different firm life-cycle stages. [↑](#footnote-ref-3)
4. According to Barberis et al. (1998), after a trend of good or bad information, representativeness causes investors to overreact to information and push the price too high. Hong and Stein (1999) argue that momentum traders make decisions conditional on past price change; that is, momentum traders push stock prices higher (lower) when there is an up (down) trend. [↑](#footnote-ref-4)
5. Alti and Tetlock (2014) use a structure model approach to study behaviour biases on asset prices. They also identify overextrapolative belief as a main cause of mispricing. [↑](#footnote-ref-5)
6. Hribar and Yehuda (2015) also employ the firm life-cycle concept to study the mispricing of accrual and cash flow information by the stock market. They show that both total accruals and free cash flows are mispriced to the highest degree in the growth stage. However, the focus of their study was to highlight the different information contents of accrual and cash flow in different firm life-cycle. There was little discussion on the reason for the difference in the strength of anomaly in different life-cycle. [↑](#footnote-ref-6)
7. Tversky and Kahneman (1974) show representativeness as a behavioral heuristic; that is, people determine probability by using a sample that they think reflects the distribution of the population. Such a process results in the bias of over-generalizing recent observations. [↑](#footnote-ref-7)
8. In general, overreaction is defined as investor overreact to past asset growth information. This works in both high and low growth firms. In other words, when investors observe a series of high (low) growth they will extrapolate and expect continued high (low) growth in the future. When this error is corrected, we observer a reversal in return for both high and low growth company.

 [↑](#footnote-ref-8)
9. Fama and French (2008), Cooper et al. (2008) and Lam and Wei (2011) do not include financial firms in the sample when investigating the asset growth anomaly. [↑](#footnote-ref-9)
10. Banz and Breen (1986) and Lam and Wei (2011) also set this requirement to select their samples in order to minimize the selection bias. [↑](#footnote-ref-10)
11. Fama and French (2008) argue that sorts can capture stock return patterns based on an anomaly variable but sorts cannot show the marginal effect and the unique information of an anomaly variable. Regression is one solution to this shortcoming of sorts. [↑](#footnote-ref-11)
12. We thank the referee for suggesting the possibility of providing further evidence of overreaction through studying price movement during the formation period. [↑](#footnote-ref-12)