The Value of Growth:
Changes in Profitability and Future Stock Returns[*]

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Abstract: We use a simple two-stage dividend growth model to connect profitability growth and firm scale to stock returns. In this framework, both the magnitude and the length of the first-stage growth play a key role in determining returns. Using current profitability growth to estimate magnitude and firm scale as inverse proxy for length, we predict that future returns should increase with current profitability growth but, crucially, the effect should diminish with firm scale. Across a range of empirical tests, we find strong evidence in support of our model determinants and predictions. Our findings are not explained by an array of associated, potentially confounding variables.

JEL classification: G11; G12

Keywords: Profitability Growth; Firm Size; Stock Returns

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Abstract: We use a simple two-stage dividend growth model to connect profitability growth and firm scale to stock returns. In this framework, both the magnitude and the length of the first-stage growth play a key role in determining returns. Using current profitability growth to estimate magnitude and firm scale as inverse proxy for length, we predict that future returns should increase with current profitability growth but, crucially, the effect should diminish with firm scale. Across a range of empirical tests, we find strong evidence in support of our model determinants and predictions. Our findings are not explained by an array of associated, potentially confounding variables.

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1. Introduction

Recent literature has documented a significant role for firms' profitability and earnings growth as cross-sectional determinants of stock returns.[1] While the magnitude of these effects attests to their economic importance, it also opens the questions of what deeper fundamental relationship drives them and what novel implications, if any, can be derived from this relationship. In this paper, we take a fundamental-valuation approach to these questions by examining both theoretically and empirically how differences in profitability trajectories across firms map into the observed cross-section of stock returns.

Our conceptual framework consists of a two-stage dividend growth model in which firms may experience abnormally high or low profitability growth over the short to medium terms, and normal, economy-wide growth in the long run. In the model, both the abnormal profitability growth and the terms over which this growth is sustained can differ across firms. Further accounting for potential differences in firms' book-to-market and current profitability ratios, we derive two main results from this framework. First, a firm's required stock return should increase with its near-term expected profitability growth. Second, the positive effect of the near-term expected profitability growth on stock returns should increase with the length of the abnormal growth period. Intuitively, the difference in future profitability between two firms with similar current profitability but different profitability growth rates will magnify with the duration of the abnormal growth phase. Thus, the two firms can have similar valuations only if a wedge between their required stock returns exists and magnifies in a similar manner with the abnormal growth duration.

In taking these results to the data, we build on a basic premise of the two-stage growth model—namely, that differences in profitability growth across firms exhibit limited persistence.

[1] See, e.g., Novy-Marx (2013, 2015), Fama and French (2015, 2016), Ball et al. (2015), and Hou, Xue, and Zhang (2015, 2020).

Empirical confirmation of this premise, which we offer by documenting a positive persistence of profitability growth across firms at relatively short horizons, allows us to use firms' current profitability growth (PG) as proxy for their near-term expected profitability growth. To further proxy for the length of firms' abnormal growth stage, we draw on the observation that smaller, less mature firms have more room to grow and increase their market share than similar larger, more mature, and consolidated firms. This observation suggests using measures of firm scale, itself a well-documented cross-sectional determinant of returns,[2] as a proxy for the inverse of the abnormal-growth length. We provide empirical support for the use of firm scale as an abnormal-growth length proxy by reporting a positive (respectively, negative) greater predictive power of abnormally high (low) profitability growth on subsequent short-term average profitability growth among small than among large firms. We then test our theoretical implications by examining two related empirical predictions: (1) firms' current profitability growth has a positive impact on their stock returns, and (2) this impact is decreasing in firm scale.

Our first approach to testing these predictions draws on standard calendar portfolios. Sorting stocks by firm size and PG and assigning them into respective size and PG groups we find, consistent with our first empirical prediction and the findings of prior literature (Novy-Marx, 2015; Hou, Mo, Xue, and Zhang, 2021), that the portfolios of stocks with the highest ("strong") PG and the lowest ("weak") PG earn the highest and lowest, respectively, average raw returns across firm size groups. As a result, the average returns on long-short portfolios that buy the strong-PG stocks and short the weak-PG stocks—hereafter "Strong-Minus-Weak" (SMW)—within each firm-size group are all positive and significant. Adjusting for risk, the SMW portfolios across firm-size groups earn economically and statistically significant alphas with respect to the French (1993), Carhart (1997), and Fama and French (2015) factor models.

[2] Banz (1981) first documented the so-called "size effect".

In line with our second empirical prediction, both the raw and risk-adjusted returns to the SMW portfolio decrease monotonically with firm size, creating a statistically significant wedge in PG effects between small and large firms. Further looking across PG quintiles, average raw returns and alphas decrease with firm size for strong-PG firms but increase instead with firm size for their weak-PG counterparts. Overall, the double-sorted portfolio evidence lends strong support to our predictions.

Our second approach relies on the Fama-MacBeth (1973) methodology to control for multiple covariates simultaneously. To this end, we run a series of cross-sectional regressions of monthly stock returns on PG and an expanding set of covariates, with our baseline controls including book-to-market, firm size, return reversal, and price momentum.[3] Our specifications aim to test whether profitability growth and its interaction with firm scale have incremental explanatory power over other well-documented, cross-sectional determinants. We are particularly interested in controlling for the effects of profitability, on the one hand, and of closely related earnings variables, on the other, on our results. Regarding the former, in our framework stock returns increase with the level of a firm's profitability. Given that profitability has been shown to be associated with higher future returns (Novy-Marx, 2013), a potential explanation of our findings could be that highly profitable firms are also those with high past (and current) profitability growth. Regarding the latter, a large literature documents a "post-earnings-announcement drift (PEAD)," or "fundamental momentum" anomaly, whereby earnings surprises are positively associated with future returns in the cross-section (Ball and Brown, 1968; Bernard and Thomas, 1989; Novy-Marx, 2015).

When we run our regressions controlling for profitability levels and four different earnings surprise measures, the coefficient on PG and its interaction with firm scale in our

[3] See, for example, Banz (1981); Rosenberg, Reid and Lanstein (1985); Fama and French (1992, 1993, 1996); Jegadeesh (1990); Jegadeesh and Titman (1993).

regressions remain positive and negative, respectively, and statistically significant.[4] Consistent with our predictions, these coefficients imply that: (i) PG has a positive impact on stock returns, and (ii) the impact is decreasing in firm scale. They further imply that firm scale has a negative effect on stock return for all but sufficiently low-profitability growth firms, for which stock returns increase in firm scale.

Lastly, we carry out several additional analyses. First, we investigate the longer-term performance of firm profitability and scale using double-sorted portfolios. To the extent that smaller firm scale is associated with stronger and longer-lasting PG effects, our framework implies a positive and widening gap between the cumulated returns to the SMW portfolios of small and large firms as the investment horizon increases. In line with this implication, when we compare the average returns of the SMW portfolios of large versus small firms beyond the first month after portfolio formation, we find longer lasting and substantially larger returns to the SMW portfolio of small firms relative to large firms. Second, we check the robustness of our results to several alternative measures of firm scale: revenue, total assets, book equity, market share, and number of employees. Across all measures, the results remain largely consistent with our predictions, indicating that our main findings are not driven by the firm scale proxy employed. Third, we test whether our results are robust to the exclusion of micro-cap firms, and to demeaning profitability growth by industry. Splitting the sample across two definitions of micro-cap, we observe that the coefficients in question retain their original sign and remain statistically significant. Our results remain strong also in portfolio and regression analyses that demean our profitability growth proxies by industry median.

[4] We also investigate whether the PG effect on returns is different from Akbas, Jiang, and Koch's (2017) "profits trend" effect. These authors show that a firm's profits trend, defined as the trajectory in a its profits-to-assets, predicts profitability and stock returns in the cross-section. We find that even though this effect is still present in our sample, it does not drive out, nor is it more statistically or economically important, than the PG effect we report.

Our study contributes to the literature connecting firm profitability to the cross-section of stock returns. Future profitability can be expressed as a combination of current levels and future growth (Fama and French, 2006), and while the literature has examined extensively the relation between returns and profitability levels, their link to profitability growth has been explored to a much lesser extent. Using return-on-equity (ROE) to measure profitability, Novy-Marx (2015) decomposes current profitability into lagged profitability and the growth in profitability to observe that the latter itself predicts returns. Using univariate and factor spanning tests, he finds that the excess returns to an ROE factor are driven by recent innovations to, as opposed to the level of, earnings. Hou, Mo, Xue, and Zhang (2021) construct a change-in-ROE factor and document that a model that includes this factor outperforms established beta pricing models. Our approach builds on the insights of these studies and considers profitability growth in the context of a simple fundamental valuation model, similarly to Fama and French (2006), instead of in a factor pricing model. Doing so allows us to derive novel insights into, and to document empirically, the relation between profitability growth, firm scale, and returns.

We additionally complement the empirical literature on the implications of growth for stock returns. At the macroeconomic level, Da, Jagannathan and Shen (2014) and Barroso, Boons and Karehnke (2021) link market earnings growth and consumption growth to the market returns. At the microeconomic level, Li, Wang, and Yu (2021) and Hou, Mo, Xue and Zhang (2021) investigate the implication for stock returns of investment growth. Our analysis at the stock level is similar to the latter, but our aim instead is to better understand the implications for returns of growth in profitability.

2. Valuation Framework

We introduce a simple framework of firm valuation to motivate our empirical analysis and interpret the results.[5] Let M_{it} and Y_{it} be, respectively, the market value of equity of firm i at the start of period t and the firm's profits after interest payments at the end of the period comprised between t - 1 and t. Assume, for simplicity, a 100%-payout policy with future net cash flows equal to future profits. Given a required (i.e., internal) rate of return r_{it} on future expected cash flows, the market value of firm i can be expressed as the present value of its expected future profits

$$M_{it} = \sum_{s=1}^{\infty} \frac{E_t Y_{it+s}}{(1 + r_{it})^s}. \tag{1}$$

For $s \geq 0$, firm i's profits grow at a (possibly stochastic) rate g_{it+s+1} from $t + s$ to $t + s + 1$, so that $Y_{it+s+1} = Y_{it+s}(1 + g_{it+s+1})$. In the spirit of a two-stage Gordon growth model, we let firm profits grow at different average rates between t and $t+T_i$ ($T_i > 0$), and afterwards. Specifically, in the near term s such that $0 \leq s \leq T_i$, we allow firm i's profits to grow at the rate $g_{it+s} = g_i + e_{it+s}$, where e_{it+s} is a zero-mean ($E_t e_{it+\tau} = 0, \tau > 0$) random shock to firm i's profits, and $g_i < r_{it}$ is firm i's constant growth rate of profits over the near term. We assume that e_{it+s} ($s = 1,2, \dots$) reflect true "surprises" from the perspective of market participants, in the sense of being unpredictable and thus uncorrelated through time. In the long term s such that $s > T_i$, all firms' profits grow at the rate $g_{it+s} = g + e_{it+s}$, where e_{it+s} is as before and $g < r_{it}$ is the expected long-term profits growth rate reflecting the economy-wide productivity and population growth rates. Thus, the assumed two-stage profit-growth dynamics recognizes that firms may experience periods of abnormal growth in profits—following, e.g., firm-specific productivity shocks with some level of persistence—before returning to a normal, long-term growth path, where all firms' expected profits grow at the common rate g.

[5] We are indebted to Bruce Grundy for suggesting the analysis in this section.

Given these assumptions, it is straightforward to show that Equation (1) simplifies to a two-stage cash-flow discount model where the current market value of firm i's equity is given by

$$M_{it} = Y_{it}\left(\frac{1+g_i}{r_{it}-g_i} - \left(\frac{1+g_i}{1+r_{it}}\right)^{T_i}\left(\frac{1+g_i}{r_{it}-g_i} - \frac{1+g}{r_{it}-g}\right)\right).$$

Scaling both sides of this equation by the book value of firm i's equity B_{it} at the beginning of period t yields:

$$MB_{it} = YB_{it}\left(\frac{1+g_i}{r_{it}-g_i} - \left(\frac{1+g_i}{1+r_{it}}\right)^{T_i}\left(\frac{1+g_i}{r_{it}-g_i} - \frac{1+g}{r_{it}-g}\right)\right), \qquad (2)$$

where $MB_{it} \equiv M_{it}/B_{it}$ and $YB_{it} \equiv Y_{it}/B_{it}$ denote, respectively, the current (time-t) market-to-book ratio and the profitability of firm i. Following this equation, g_i and g can alternatively be interpreted as the expected *profitability* growth rates over the near (g_i) and long (g) terms.

For each time t, Equation (2) defines an implicit cross-sectional relationship between the required rate of rate r_{it} on firms' shares, their market-to-book ratios MB_{it}, their current profitability YB_{it}, their near-term expected profitability growth g_i, and the length of the abnormal growth period T_i. Using the Implicit Function Theorem to analyze the nature of this relationship, we arrive at the following result:

Result R1: *In the two-stage firm dividend growth model* (*2*), *keeping all else equal a firm's required rate of return* r_{it} *should* increase *with its near-term expected profitability growth* g_i.

The proof of R1 is in Appendix B. Following this proof, it is straightforward to show that, all else equal, the required rate of return r_{it} should also be higher for firms with higher current profitability YB_{it} or with lower market-to-book ratio MB_{it}.

R1 formalizes the intuition that, among firms with similar current profitability, market-to-book ratio and abnormal growth duration, those expected to experience an abnormally high (low) profitability growth g_i should yield higher (lower) stock returns for as long as this abnormal growth persists.

Equation (2) suggests that the cross-sectional effect of a firm's abnormal profitability growth on stock returns could depend on the *duration* of this growth. To examine this implication, we solve numerically for r_{it} in Equation (2) for a range of model parametrizations. We illustrate our results in Figure 1, which plots the required rate of stock return as a function of the profitability growth across different abnormal-growth durations (Panel A), and as a function of the abnormal-growth duration across different expected near-term profitability growth rates (Panel B). Inspection of Figure 1 reveals that the positive effect of the profitability growth rate g_i on the stock return is greater among firms with longer abnormal-growth periods (Panel A), thus leading to an increasing stock return differential between high- and low-growth firms as the duration of their abnormal-growth period rises (Panel B). We summarize these observations in the following:

Result R2: *In the two-stage firm dividend growth model* (2), *keeping all else equal the positive effect of the near-term profitability growth g_i on stock returns* increases *with the length T_i of the abnormal growth period*.

[Insert Figure 1 here]

The longer the abnormal-growth period, the faster the required rate of return on a firm's stock increases with the near-term profitability growth rate. Intuitively, the difference in future profitability between two firms with identical current profitability but different profitability growth rates will magnify with the duration of the abnormal growth period. It follows that these firms can have identical valuation (book-to-market) ratios only if the difference in their required stock returns magnifies with this duration in a similar manner.

The two-stage dividend growth model in Equation (2) and the corresponding results R1 and R2 are the basis of our empirical examination of the cross-section of stock returns. To start, the basic premise behind the two-stage dividend growth model is that firms experience a limited-duration period of abnormal profitability growth. Thus, cross-sectional differences in profitability growth are persistent over, but not beyond, this period (see Appendix B). We examine whether this premise holds in our sample by testing the following:

Assumption A1: *Cross-sectional differences in firms' profitability growth exhibit limited persistence*.

According to results R1 and R2, cross-sectional differences in either near-term profitability growth or the length of the abnormal-growth period map to differences in required stock returns (R1), with the magnitude of these differences depending on the length of the abnormal growth period (R2). A first challenge with the empirical implementation of these results is that the expected near-term profitability growth g_i of firms is not observable. If A1 holds in the data, however, the near-term persistence of profitability growth implies that current profitability growth g_{it} can be used as proxy for g_i. A second empirical challenge is that the duration T_i of the abnormal growth period is not observable either. To proxy for how long a firm sustains an abnormally high (or low) current profitability growth, we draw on the observation that smaller, less mature firms have more room to grow and increase their market share than similar larger, more mature and consolidated firms. This observation leads to the following:

Assumption A2: *The difference in profitability growth with respect to a typical firm in the cross section is more persistent among small-scale firms.*

Empirical validation of A2, which we present in Section 4, allows us to use measures of firm scale as a proxy for $1/T_i$. Our analysis throughout the rest of the paper draws on these proxies to test the following empirical counterparts of R1 and R2:

Prediction P1: *Keeping other cross-sectional determinants constant, firms' current profitability growth has a positive impact on their stock returns.*

Prediction P2: *Keeping other cross-sectional determinants constant, the positive impact of PG on stock returns is decreasing in firm scale.*

3. Sample Construction

Our sample includes all common stocks (share codes 10 or 11) traded on the New York Stock Exchange (NYSE), the American Stock Exchange (Amex) and NASDAQ comprised in the Center for Research in Security Prices (CRSP) monthly files. We obtain accounting data from Compustat. Our sample excludes financial firms (i.e., firms with one-digit standard industrial classification codes of six), closed-end funds, real estate investment trusts, American depository receipts, foreign stocks and stocks with non-positive book equity.

Our main variable of interest, profitability growth (PG), is measured as the year-over-year change in profits over the lagged book value of equity (see Appendix A for details for variable constructions). We follow Fama and French (2015) and use operating profits as our profits measure, calculated as revenue less cost of goods sold, selling, general and administrative expenses, and interest expenses.[6] Specifically, our baseline operating PG measure at month *t* is defined as

$$PG_{i,q} = \frac{(OP_{i,q} - OP_{i,q-4})}{BE_{i,q-4}}, \quad (3)$$

where $OP_{i,q}$ is the operating profit in the most recent quarter, $OP_{i,q-4}$ is the operating profit lagged four quarters, and $BE_{i,q-4}$ is the book equity lagged four quarters. Following Aharoni, Grundy and Zeng (2013), we construct our accounting measures using data at the *firm* level,

[6] Our choice is meant to facilitate a comparison with Fama and French (2006) and Aharoni, Grundy and Zeng (2013), both of which examine, as we do, the explanatory power of profits deflated by book equity in the context of the valuation equation.

instead of at the per-share level, and compute relevant ratios (e.g., market to book) using the corresponding firm-level accounting variables.[7]

As argued in Section 2, our proxy for (the inverse of) the duration of a firm's abnormal growth period is firm scale. The intuition is that smaller, less mature firms have more room to grow and increase their market share than similar larger, more mature and consolidated firms, so they should be able to sustain a given growth pace for longer. Our primary measure of firm scale is market capitalization, a widely used measure of firm size that has been shown to be a strong cross-sectional predictor (e.g., Banz, 1981). In Section 7, our alternative firm scale proxies include revenue, total assets, book equity, market share, and number of employees. A main difference between our primary and alternative firm scale measures is that the former depends on market prices and thus is explicitly forward-looking in nature, while the latter are not.

A consideration in our empirical analysis is the timing of information releases relative to portfolio formation. Bartram and Grinblatt (2018) use Compustat Point-In-Time data to form a hypothetical trading strategy only after data has been made public. We take a different route and web scrape 10-Q and 10-K filing dates directly from SEC EDGAR from 1993, the earliest available filing year, to 2019. When filing dates are not available, we use the average filing lag (i.e., the number of days from the fiscal year end to the 10-Q/10-K filing date) as proxy from 1993 to 2002 to proxy for a filing date for the early years. We then identify a new announcement date as the later date of earning announcements dates and filing dates to ensure financial variables were available publicly when computing various variables.

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[7] As Aharoni, Grundy and Zeng (2013) point out, the valuation formula of the dividend-discount model does not necessarily hold in a per-share analysis. Hence, tests of this formula that use proxies such as PG for expected profitability at the per-share level can be misspecified. The authors illustrate their insight with the limited or non-existent support that Fama and French (2006) find at the per-share level for the positive and negative relationship that the dividend discount model predicts between stock returns and, respectively, a firm's expected profitability or investment. They show that once the corresponding accounting variables are measured at the firm level, both expected profitability and investment become stronger predictors, with the right sign, in the data.

4. Profitability Growth Persistence in the Cross-Section

A basic assumption underlying our framework, stated as Assumption A1 in Section 2, is that cross-sectional differences in firms' profitability growth exhibit a positive but limited persistence. If this is the case, currently observed profitability growth differences are informative about the near-term expected profitability growth differentials that our results relate to the cross-section of stock returns.

Our first approach to assessing the persistence of differences across firms' profitability growth consists in running Fama-MacBeth (1973) regressions of PG on prior PG lagged up to eight quarters. The cross-sectional specification allows us to test whether *differences* in PG across firms in any given period persist, as assumption A1 requires, over the next few periods, and vanish over longer terms.[8] Table 1 reports the results of this analysis.

[Insert Table 1 here]

Model (1), which includes all eight lags of PG as explanatory variables, shows that differences in firms' current PG are positively and statistically significantly predicted by their differences one, two, five and six quarters before, providing evidence of positive persistence in the near term. This persistence, however, is limited. First, PG in the most recent quarter exhibits by far the largest economic and statistical significance as a predictor of future PG. Second, the positive persistence seems to be partially offset by a negative persistence after one and two years, as the coefficients on lags four and eight are negative and statistically significant. Lastly, when we examine the coefficients associated to lags one to four on an individual basis in models (2) to (5), the positive estimated coefficients for lags one to three decrease

[8] By contrast, a time-series specification would require that we run time-series regressions of each individual firm's current PG on lagged values of PG. The average of the resulting coefficients would be informative about the persistence (serial correlation) of PG for the average firm in our sample. Our purpose, in contrast, is to assess whether differences in PG are, on average, persistent. The reason is that even if PG is not persistent for the average firm in our sample, to the extent that the differences between this firm's PG and other firms' PG are persistent, they should still map to cross-sectional differences in stock returns according to our model. We thank an anonymous referee for drawing our attention to this issue.

monotonically in both magnitude and statistical significance, while the estimated coefficient at lag four again shows up as negative and strongly statistically significant—although not large enough in magnitude to offset the cumulated positive effect of lags one to three. Results from similar (non-tabulated) tests that account for up to twelve lags of PG do not change significantly from those in Table 1.

A second assumption underlying our empirical predictions is the existence of cross-sectional variation in profitability growth persistence, according to which smaller firms are more likely than larger firms to experience abnormal profitability growth. If this is the case, the persistence in the profitability growth of small firms should be stronger than that of their larger peers (Assumption A2).

We first adopt a nonparametric approach to preview the plausibility of this assumption. Figure 2 presents binned scatter plots of the relationships between firms' next-quarter PG and market capitalization across firms experiencing abnormally high, abnormally low, or normal profitability growth. Several patterns consistent with A1 and, more importantly, A2, are evident. First, in line with Assumption A1 and our results from Table 1, PG is persistent. Firms experiencing abnormally high, normal, or abnormally low PG in a quarter exhibit higher-than-average, average or lower-than-average PG, respectively, in subsequent quarters. Second, among firms with similar *abnormal* profitability-growth in a given quarter, differences in firm size are associated with significant differences in next-quarter PG. In particular, smaller firms with abnormally high PG seem to experience, on average, a stronger subsequent PG than larger firms in a similar abnormally high profitability-growth stage. Conversely, the subsequent PG of firms in an abnormally low profitability-growth stage is weak in general but seems even weaker among smaller firms.

[Insert Figure 2 here]

Next, we adopt a regression approach to assess the economic and statistical significance of our observations from Fig. 2 and expand our predictability analysis over longer time horizons. To reduce the impact of overlapping horizons on our estimates, we adopt a firm-event as the unit of observation, where the event is defined as the set of consecutive quarters over which the firm stays in a particular profitability-growth phase (abnormally high, normal, or abnormally low PG). A firm's PG is classified as abnormally high, abnormally low, or normal, depending on whether it ranks in the top 30%, the bottom 30%, or the remaining 40% of the cross-sectional distribution.[9] Based on these definitions and the insights from Fig. 2, we examine the presence of cross-sectional variation in the predictability of PG at different time horizons by estimating the following specification:

$$\begin{aligned} PG_{i,[q+1,q+k]} = {} & \alpha + \beta_1 DPG\_L_{i,q} + \beta_2 DPG\_H_{i,q} + \gamma_1 DME\_S_{i,q} + \gamma_2 DME\_M_{i,q} \\ & + \delta_{11} DPG\_L_{i,q} \times DME\_S_{i,q} + \delta_{21} DPG\_H_{i,q} \times DME\_S_{i,q} \\ & + \delta_{12} DPG\_L_{i,q} \times DME\_M_{i,q} + \delta_{22} DPG\_H_{i,q} \times DME\_M_{i,q} + \varepsilon_{i,q+k}, \end{aligned} \tag{4}$$

where $PG_{i,[q+1,q+k]}$ is the average profitability growth of firm *i* from quarters *q*+1 to *q*+*k* , for *k* = 1, 2, 3, 4, 8, and *q* denotes the first quarter of a profitability growth phase. The set of regressors includes the dummy variables DPG_H and DPG_L, which equal 1 if the firm belongs in either the abnormally high or abnormally low profitability-growth groups, respectively, and 0 otherwise; the dummy variables DME_S and DME_M, which equal 1 if the firm belongs in either the small or the medium market capitalization groups, respectively, and 0 otherwise; as well as the four interactions between abnormal-PG and firm-size dummies. Our main coefficients of interest are δ_{21} and δ_{11}, which represent the difference between small and large firms in changes in average profitability growth over the subsequent *k* quarters from

[9] This is the same criterion we apply in the construction of Fig. 2. For robustness, we repeated the analysis in Fig. 2 and Table 2 below by changing the definition of abnormal growth to the top and bottom quintiles (instead of the top and bottom 30%) of the PG cross-sectional distribution and obtained very similar results.

moving from a normal to an abnormally high (δ_{21}) or low (δ_{11}) profitability-growth phase.[10] Empirical validation of Assumption A2 requires that $\delta_{21} > 0$ and $\delta_{11} < 0$.

[Insert Table 2 here]

The results, presented in Table 2, largely support Assumption A2. In line with our findings from Fig. 1, the positive (respectively, negative) sign of the estimated coefficient for DPG_H (DPG_L) indicates that large firms—our base group for the firm size dummy—moving from a normal—our base group for the anormal profitability-growth dummy—to an abnormally high (low) profitability-growth phase experience a significantly higher (lower) profitability growth in the following 1 to 8 quarters. In both cases, the magnitude of the estimated effects decreases with the horizon, hinting at the same strong but limited cross-sectional persistence in PG that we hypothesize in Assumption A1 and confirm empirically in our analysis above.

Importantly, our estimates for δ_{21} (respectively, δ_{11}) indicate that the corresponding increase (decrease) in profitability growth among smaller firms is at least 25% larger (e.g., comparing estimates for δ_{21} and β_2 for *k*=1) and statistically significant at the 1% level or better, over the next one to four quarters. Thus, as conjectured in A2, the persistence in profitability growth decreases cross-sectionally with firm scale, even if it remains significant among large firms.

Our findings in this section are thus consistent with Assumptions A1 and A2. In particular, they validate (1) the use of current PG as a cross-sectional signal of future PG; (2) the use of

[10] Formally,

$$\begin{aligned}\delta_{21} = \big(&E\big[PG_{i,[q+1,q+k]} | DPG\_H_{i,q} = 1, DME\_S_{i,q} = 1\big] \\ &- E\big[PG_{i,[q+1,q+k]} | DPG\_H_{i,q} = 1, DME\_S_{i,q} = 0, DME\_M_{i,q} = 0\big]\big) \\ &- \big(E\big[PG_{i,[q+1,q+k]} | DPG\_H_{i,q} = 0, DPG\_L_{i,q} = 0, DME\_S_{i,q} = 1\big] \\ &- E\big[PG_{i,[q+1,q+k]} | DPG\_H_{i,q} = 0, DPG\_L_{i,q} = 0, DME\_S_{i,q} = 0, DME\_M_{i,q} = 0\big]\big),\end{aligned}$$

and analogously for δ_{11}.

firm scale as a proxy for the duration of a firm's abnormal profitability growth stage; and (3) the link between our theoretical result R2 and its empirical counterpart P2.

5. Profitability Growth and Length Effects on Stock Returns: Portfolio Analysis

Our first tests of predictions P1 and P2 involve constructing standard calendar portfolios. These tests allow us to assess the empirical and economic relevance of our results without imposing parametric relationships between the variables. In Section 5.1 we use single-sorted portfolios to summarize the characteristics of firms experiencing different profitability-growth phases. In Section 5.2 we use double-sorted portfolios to examine the presence of a profitability-growth cross-sectional effect on stock returns (P1) and its potential variation across firm scale levels (P2).

5.1 Characteristics of Profitability Growth-Sorted Portfolios

Each month, we sort stocks into deciles based on their most recent publicly available PG. To ensure that the corresponding information is publicly available at the time of portfolio formation, we use quarterly accounting data that were announced prior to the date of portfolio formation. Specifically, we require the 10-Q/K filing dates to take place before this date. For example, if the profit-related variables for the fourth fiscal quarter of 2012 are publicly announced on February 10 of 2013, we use these variables to form portfolios at the beginning of March 2013. Furthermore, to avoid stale accounting data, we require the filing date to be within three months preceding portfolio formation. Given a filing in month t, we examine the performance of the PG decile portfolios from month $t+1$ onwards.[11]

[11] Nonearning variables like revenues and cost of goods sold may not be available at earnings announcement dates (Easton and Zmijewski, 1993; Bartram and Grinblatt, 2018). We web scrape 10-Q and 10-K filing dates from

After assigning each firm to one of the ten deciles based on its most recent measure of PG, in Table 3 we tabulate the following characteristics for each portfolios: Market Equity (ME); Book-to-Market ratio (B/M); Operating Profitability scaled by Book Equity (OP/B); prior-year return ($r_{-12,-2}$), skipping the most recent prior month; and current-quarter PG. Moving from the portfolios with the lowest PG ("Weak") to those with the highest PG ("Strong"), we observe market equity to be inverted-U shaped but negatively skewed.[12] Book-to-market ratios have a similar inverted-U shape but positive skewness, with strong PG firms having a lower ratio than weak PG firms. This pattern seems consistent with high growth signaling greater future growth opportunities, which are likely reflected in market prices but not in book values. Operating profitability displays a U-shaped relationship with PG growth, implying that the least profitable firms are likely to currently experience moderate growth. Except for the first PG decile, average prior-year returns increase monotonically with firm profitability growth, indicating that stock returns and profitability growth are in line over the same (one-year) period.

[Insert Table 3 here]

5.2 Profitability-Growth Effect and Firm Scale

In our double-sorted portfolio analysis, each month we first sort stocks by lagged firm scale and assign them into quintiles. We denote the bottom- and top-firm scale quintiles as "Small" and "Large," respectively, and the three middle-size quintiles as "Mid". Within each firm-scale group, we then sort stocks by PG and assign them into quintiles ranging from "Weak" (bottom

SEC EDGAR since the early available filing year of 1993. To improve the timeliness of 10-Q and 10-K filings, the SEC accelerated quarterly and annual financial reporting twice in 2003 and 2006. We use the average filing lag (i.e., the number of days from the fiscal year end to the 10-Q/10-K filing date) from 1993 to 2002 to proxy for a filing date for earlier years when filing dates are not available. We then identify a new announcement day as the later day of earning announcements dates and filing dates to ensure financial variables available publicly when computing various variables.

[12] Our valuation framework makes no prediction about the correlation between *observed* PG and firm scale since the former contains an idiosyncratic component. That said, one might expect more idiosyncratic variation in PG for smaller firms, which would imply firm size being U-shaped relative to PG.

quintile) to "Strong" (top quintile) PG. Table 4 reports VW average monthly raw returns (Panel A) as well as VW three-factor (Fama and French, 1993), four-factor (Carhart, 1997) and five-factor (Fama and French, 2015) alphas (Panels B to D) for each of the resulting portfolios,[13] as well as for the zero-cost investment portfolios that buy the strong-PG quintile and short the weak-PG quintile ("Strong-Minus-Weak," or SMW) across firm-scale groups.[14]

[Insert Table 4 here]

Consistent with prediction P1, Panel A shows that average returns increase nearly monotonically from the weakest PG quintile to the strongest PG quintile among the small and mid-sized firms. Even among large firms, the strong- and weak-PG portfolios earn the highest and lowest, respectively, raw returns. As a result, the average returns on the long-short SMW portfolios across all firm-scale groups are positive and significant.

Panels B to D indicate, consistent with the prior literature on earnings growth and stock returns, that the PG effect on raw returns of Panel A is not compensation for the portfolios' exposure to priced factors with which PG could be correlated. Across factor models, the patterns in alphas are qualitatively similar to the pattern in raw returns. For all firm-scale groups, three-factor alphas (Panel B) typically increase with PG and the associated SMW alphas are positive and statistically significant. The patterns are very similar when we examine four- (Panel C) and five-factor (Panel D) alphas. Across models, the SMW portfolios of small and mid-sized firms earn economically large and highly statistically significant alphas, whereas the SMW alphas of large firms is positive across factor models and statistically significant under all but the four-factor model.[15]

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[13] The three factors of Fama and French (1993), the four factors of Carhart (1997) and the five factors of Fama and French (2015) were obtained from Kenneth French's webpage.

[14] In nontabulated results, we reconstruct Table 4 using NYSE breakpoints to define the quintiles. The results are qualitatively identical, with the key statistics having the same sign and statistical significance.

[15] Across most columns, *t*-values associated to the SMW alphas exceed the suggested cut-off values of 3 in Harvey, Liu and Zhu (2016) and of 3.8 in Chordia, Goyal and Saretto (2020).

Crucially, a comparison of the patterns across firm scale groups also provides strong support for our empirical implication P2. First, the PG effect on stock returns decreases monotonically with firm scale. Indeed, the average raw returns to the SMW portfolios of small and large firms are, respectively, 2.10% and 0.31% per month, creating a statistically significant spread of 1.79% per month between the two portfolios. The same pattern is present in risk-adjusted returns, leading to alpha spreads between the small- and large-firm SMW portfolios of 1.65%, 1.74% and 1.58% per month across the three-, four- and five-factor models.

Second, whether firm scale has a negative or positive impact on stock returns depends on whether the firm experiences high or low profitability growth. Looking across PG quintiles in Table 4, VW average raw returns and alphas decrease with firm scale for the three strongest-PG quintiles but increase with firm scale for the other two (weak-) PG counterparts. These patterns result in a "reverse" size effect within the weak-PG portfolios, according to which a portfolio that buys large firms and short sells small firms, which we term "Large Minus Small" (LMS), generates positive and potentially sizable returns and alphas. Thus, the performance of the LMS portfolio decreases from the weakest-PG to the strongest-PG quintiles across raw returns and alpha measures, with the returns to the LMS portfolio among the weakest-PG and the strongest-PG quintiles being of similar magnitude but opposite signs (e.g., average raw returns and five-factor alphas of, respectively, 0.73% and 0.76% per month for the weak-PG portfolio, compared to -1.06% and -0.82% per month for the strong-PG portfolio).

The results are not sensitive to the sequence of the double sorting. We recalculate average raw returns and alphas using two additional schemes: one, a sequential double sort first on PG, then on firm scale, and two, an independent double sort on PG and firm scale. In unreported results, we find similar results both qualitatively and quantitatively across both alternative sorting schemes for all four measures of returns. Overall, we interpret this evidence based on double-sorted portfolios as strong support for our empirical predictions.

6. Controls for Other Profitability-Related Variables: Fama-MacBeth Analysis

Our second set of tests relies on the Fama-MacBeth (1973) methodology to control for multiple stock-level characteristics simultaneously. Our aim is to estimate the incremental effect of profitability growth and its interaction with firm scale on the cross-section of average returns after conditioning on other well-documented determinants. Of particular interest is the degree to which our main variables predict future returns once we control for profitability levels (Novy-Marx, 2013), post-earnings-announcement drift (e.g., Ball and Brown, 1968), and the trend in profits (Akbas, Jiang and Koch, 2017), given the potential overlaps between PG and these measures.[16]

All the models in this section regress one-month-ahead stock returns on a set of control variables, a subset of which is fixed across models: the log of a firm's book-to-market ratio (B/M), the log of firm size (ME), prior one-month stock returns ($r_{0,1}$) and prior-year stock returns ($r_{2,12}$) (Banz, 1981; Rosenberg, Reid and Lanstein, 1985; Fama and French, 1992, 1993, 1996; Jegadeesh, 1990; Jegadeesh and Titman, 1993).[17] To reduce the impact of extreme values, we trim the independent variables at the 0.5% and 99.5% levels. For a firm to be included in the cross-sectional regression analysis in a given month *t*, we require price data to appear in CRSP from month *t*-11 to *t*+1. Additionally, data must be available on the Compustat annual and quarterly files to calculate the book-to-market ratio and PG.

[16] Current profitability growth and firm scale are noisy proxies for the underlying near-term expected profitability growth g_i and the length of the abnormal growth period T_i in our model. Thus, their inclusion as covariates in our regressions in this section can potentially create an errors-in-variables problem that leads to inconsistent estimates for the coefficients of interest on PG and the interaction term PG×Firm Scale due to an attenuation bias (Wooldridge, 2010). Note, however, that because both coefficients are positive in theory, this problem biases our estimates *against* finding significant effects, as the estimated coefficients should understate the true parameters. The fact that we find significant effect despite this attenuation bias reinforces the validity of our results as evidence in favor of our predictions.

[17] In our model, keeping all else constant higher book-to-market ratios lead to higher required stock returns (see Section 2). This implication is consistent with the existing empirical evidence. Thus, it is important to control for firms' book-to-market ratios when assessing the effect of the other variables (e.g., PG) on stock returns.

6.1. Profitability Levels

In our framework, stock returns increase with the level of a firm's profitability. This implication is in line with the positive cross-sectional relationship between the two variables established by prior studies (Novy-Marx, 2013; Ball et al., 2015; Fama and French, 2015). A potential explanation for our findings could then be that highly profitable firms are also those with high past (and current) profitability growth. To rule out this possibility and examine the incremental impact of PG and its interaction with firm scale on stock returns following P1 and P2, we first compare their explanatory power to that of profitability levels (OP/B). Table 5 reports average coefficients and *t*-values from Fama-MacBeth (1973) cross-sectional regressions. Model (1) indicates that our sample is standard, as the coefficients on the level of profitability and other cross-sectional determinants (e.g., book-to-market) have the correct sign and are all statistically significant.

[Insert Table 5 here]

Controlling for all these determinants simultaneously, models (2) and (3) show that PG has incremental explanatory power over book-to-market, size, return reversal, momentum (model (2)), and profitability levels (model (3)). Consistent with P1, the slopes on PG across both models are positive and highly statistically significant ($t > 10$), suggesting that all else equal firms with higher PG experience higher average future returns. In line with our theoretical framework, both PG and profitability levels have independent explanatory power on expected returns according to model (3), where PG has incremental explanatory power over current profitability levels (OP/B) and the latter retains its sign and statistical significance. Prior-year returns, which proxy for price-momentum effects, turn insignificant once PG is controlled for, which suggests that PG might absorb part of the momentum effect.[18]

[18] In other words, firms with positive PG tend to become momentum winners, while firms with negative PG tend to become momentum losers. The momentum effect is not absorbed by the profitability levels, as it remains

Crucially, the sign and statistical significance of the interaction term between PG and firm scale in model (4) confirm our portfolio-level evidence in support of P2. Indeed, the coefficient on this interaction term is negative and highly statistically significant. Given that the coefficient on PG remains positive and statistically significant in this specification, these estimates indicate that, in line with our framework's predictions, the profitability growth effect on stock returns is not only positive but also decreasing in firm scale. Further considering that the coefficient on firm scale (market capitalization) remains negative and statistically significant, the results in model (4) show that firm scale has a negative effect on stock return for all but sufficiently low-profitability growth firms (i.e., firms with PG < -0.10/1.04 = -0.096), for which stock returns increase in firm scale. These results confirm that the patterns observed in the two-way sorts in Section 5.2 are robust to controlling for not just factor exposures but also firm characteristics.

6.2. Earnings Surprises

Our PG measure reflects the most recent year-over-year changes in firm profitability, and under a seasonal random-walk model for firm profits, these changes might reflect the surprise component of the firm's most recent profits or profit innovations. A large literature documents a "post-earnings-announcement drift (PEAD)," or "fundamental momentum" anomaly, whereby innovations in earnings (earnings "surprises" (ES)) are positively associated with future returns in the cross-section (e.g., Ball and Brown, 1968; Bernard and Thomas, 1989; Novy-Marx, 2015). In particular, Novy-Marx (2015) shows that a factor based on the year-over-year changes in earnings, scaled by lagged book equity, can price momentum portfolios.

significant before the addition of the profitability-growth variable in model (2). These results seem consistent with Johnson's (2002) rationalization of the momentum effect. In related studies, Novy-Marx (2015) finds that earnings innovations are a driver of price-momentum effects, while Hou, Xue and Zhang (2015) suggest that shocks to profitability levels are positively correlated to stock returns.

Given the positive relation between PG and price momentum reported in Table 2, these findings raise the question of whether PG is another manifestation of the PEAD effect.

To examine whether this is the case, we test the relationship between PG and one-month-ahead stock returns after controlling for earnings surprises. We use four different types of ES measures: cumulative three-day abnormal returns (CAR), standardized unexpected earnings (SUE), and earnings ("fundamental") momentum. Our first ES measure (in models (1) and (2)) is the cumulative abnormal returns (CAR), which is defined as the cumulative three-day abnormal returns around the announcement (i.e., one day before the event to one day after). The second measure (in columns (3) and (4)) is standardized unexpected earnings (SUE), which is defined as the change in earnings per share between the most-recent-quarter earnings announcement and the earnings announcement four quarters before, divided by the standard deviation of the change in earnings per share over the prior eight quarters. The third ES measure (in models (5) and (6)) is standardized unexpected earnings at firm level (SUE, firm), which is defined as the year-over-year change in earnings before extraordinary items, divided by the standard deviation of changes over the prior eight quarters. This measure is based on firm-level data and hence is directly comparable with PG, as argued by Aharoni, Grundy and Zeng (2013).[19] Since this measure is based on per-share data rather than firm-level data, it differs more from PG at a fundamental level than the other SUE measure. The fourth and final ES measure (in models (7) and (8)) is earnings momentum, which is defined as the year-over-year change in earnings before extraordinary items, divided by the book equity lagged one quarter. This measure is also based on firm-level data and is conceptually closer to PG than SUE firm level, as it also uses book equity as the deflator.

[19] See Section 2.1 of Aharoni, Grundy, and Zeng (2013) for an exposition of the arguments offered by these authors for using data at the firm level instead of at the per-share level in tests of the valuation equation.

For each ES measure, we run two sets of tests: one controlling for the ES measure alone, and another additionally controlling for PG and PG×log(ME). Results from Fama-MacBeth regressions of monthly returns are listed in Table 6. In models (1), (3), (5), and (7), when we control for only ES, we report a positive and significant relation between ES and future returns regardless of the measure used, consistent with the prior literature and validating the different ES proxies we adopt.

[Insert Table 6 here]

When we include PG and its interaction with firm scale in models (2), (4), (6), and (8), we observe that PG and the interaction term remain powerful cross-sectional predictors even after controlling for earnings surprises. Across all four ES measures, the coefficient on PG is positive and significant, while the coefficient on the interaction term of PG×log(ME) is negative and significant.[20] PG and ES are conceptually similar, so the fact that PG and PG×log(ME) remains predictive even after accounting for ES validates our empirical approach to focus on PG as opposed to earnings-related measures. More than that, the results remain consistent with our predictions. Current profitability levels (OP/B) also remain a significant determinant across ES measures and firm sizes. Ultimately, the results indicate that none of the three effects (PG, ES and OP/B) drives down the power of the others in explaining one-month-ahead average returns.

The results using Earnings Momentum (EM) to measure ES further suggest that, in the spirit of the recent profitability literature (e.g., Novy-Marx, 2013), PG could represent a cleaner measure of innovations to true economic profitability than earnings innovations. The conclusion follows from comparing PG to the earnings momentum proxy of Novy-Marx (2015).

[20] Insofar as our theoretical model is correct, that the *t*-statistic on the interaction term PG×log(ME) is relatively smaller when ES is measured by CAR than when it is measured by the other ES proxies is expected. Unlike the other proxies, CAR already captures the interaction of cash flow news and firm size, so conditioning on CAR should reduce the informativeness of PG×log(ME).

Unlike SUE, neither PG nor EM adjusts for the standard deviation of innovations. Therefore, the information content of both measures about future returns is unambiguously given by changes in either profits (PG) or earnings (EM). We observe in model (8) that after controlling for EM, PG remains a strong determinant (*t*=8.69) of stock returns, while the *t*-value of ES drops from 8.15 to 4.21.

6.3. Profit Trend

The deterministic trend in firm gross profits-to-assets can predict profitability and stock returns in the cross-section (Akbas, Jiang and Koch, 2017). To compare the predictive powers of PG and the profit trend, we follow Akbas, Jiang and Koch (2017) in estimating the profitability trend measure for firm *i* in quarter q using the following regression:

$$GP_{i,q} = \alpha_{i,q} + \beta_{i,q}t + \lambda_1 D_1 + \lambda_2 D_2 + \lambda_3 D_3 + \varepsilon_{i,q}, \tag{5}$$

where *GP* is quarterly gross profits in levels defined as sales minus quarterly cost of goods sold scaled by total assets; t=1,2,…,8, represents a deterministic time trend that includes the most recent eight quarters; and D_1 to D_3 are quarterly dummy variables that account for potential seasonality in gross profits. $\beta_{i,q}$ is the estimated profitability trend measure ("Trend"). We then run Fama-MacBeth regressions of returns on PG, the profit trend, profitability levels, and the base set of control variables. We present results without (Panel A) and with (Panel B) controls for the earnings surprise (ES) measures of the prior subsection.

Model (1) confirms Akbas, Jiang and Koch's (2017) key result: the coefficient on Trend is positive and significant. However, after PG and PG×log(ME) are included in model (2), they subsume the profit trend in the predictive regressions. The coefficient on TREND turns significant, while the coefficients on PG and PG×log(ME) remain highly statistically significant and with the expected signs from P1 and P2. Both results remain qualitatively unaltered when we additionally control for earnings surprises (ES) in models (3) through (6).

[Insert Table 7 here]

Overall, the results in Table 7 establish the incremental informational content of PG relative to the profit trend variable merely reflects of Akbas, Jiang and Koch's (2017) about the cross-section of stock returns. More broadly, they reinforce the evidence in favor of our empirical predictions regarding the combined effect of profitability growth and firm scale on stock returns.

7. Additional Analyses

In this section, we present two sets of additional analyses. First, we investigate the longer-term performance of firm profitability and scale. Second, we check the robustness of our results to: (1) alternative measures of firm scale; (2) the exclusion of micro-cap stocks; and (3) adjusting profitability growth measures by industry medians.

7.1 Longer-Run Returns

To the extent that smaller firm scale is associated with stronger and longer-lasting PG effects, our framework implies a positive and widening gap between the cumulated returns to the SMW portfolios of small and large firms as the investment horizon increases. We investigate this implication by comparing the VW average returns beyond the first month after portfolio formation of the strong-minus-weak (SMW) profitability-growth portfolios of large firms versus those of small firms. We present our results in Figure 3, where Panel A depicts monthly (with corresponding *t*-statistics) and Panel B depicts cumulated returns of these SMW portfolios for investment horizons of up to 12 months.

[Insert Figure 3 here]

We call attention to three features of the depicted patterns. First, as observed in Panel A, the SMW returns are not short-lived. Across the large and small SMW portfolios, the average return is positive and significant for six and seven months, respectively. Second, the magnitude of the SMW returns is larger for small firms. Third, as observed more clearly in Panel B, the positive spread between the cumulative returns to the SMW portfolios of small and large firms increases over the first eight months after portfolio formation and does not revert to zero within the twelve-month horizon we examine. This is the case even though the return to the SMW portfolio of large firms never becomes negative and significant, while the return to the SMW portfolio of small firms becomes negative and significant at months $t + 11$ and $t + 12$, albeit at smaller magnitudes relative to the large positive returns in the earlier months. Overall, the results indicate both that, consistent with our predictions, the cross-sectional variation across firm size predicted by our model persists over longer horizons.

7.2 Robustness

7.2.1 Alternative Firm Scale Proxies

Our results so far rely on market capitalization as proxy for firm scale. To assess the robustness of our findings, we run additional sets of Fama-MacBeth regressions on monthly stock returns using five alternative firm scale proxies: revenue, total assets, book equity, market share, and number of employees.[21] We report the corresponding results in Panels A through E of Table 8.

[Insert Table 8 here]

Our findings are not driven by the choice of firm scale proxy. Across the alternative proxies, the signs and statistical significance of the coefficients of interest, namely PG, PG×firm scale, and OP/B, do not change with respect to those reported in the previous sections, thus remaining consistent with our predictions.

[21] One could further consider firm age as an inverse proxy for the length of the abnormal-growth period in our model, under the assumption that older firms should be closer than younger firms to their long-run growth rate. A potential problem with this proxy is that the common measure of firm age, the time since public listing, may not represent the same time in firms' lifecycles across firms, given variability in firms' IPO timing.

7.2.2 Exclusion of Microcaps

We have not restricted the sample by firm size in our analysis as this characteristic, as a measure of firm scale, is our proxy for the inverse of a firm's abnormal growth duration. Following this reasoning, removing firms at the low end of the firm-scale distribution could drop the set of firms most likely to experience periods of abnormal (positive) growth from the sample. That said, we acknowledge that a potential concern with the inclusion of so-called microcap stocks is that results might be driven by a subset of very small and potentially anomalous firms.

To address this concern, we repeat our analysis by splitting the sample in two: micro-caps and all-but-micro-caps. We employ two definitions of micro-caps: first, firms below the NYSE 20% breakpoint in market capitalization, and second, firms in the bottom 40% of market capitalization in our sample. Table 9 contains results from repeating our multivariate analysis on the split subsamples, with Panel A corresponding to the NYSE 20% breakpoints and Panel B corresponding to the overall 40% breakpoints. We observe that the sign and significance of the coefficients of interest (PG, PG×log(ME)) are consistent with those of the overall sample, with the magnitudes being high for the "micro" sample, as our framework would predict. The results here indicate that our earlier results are not artifacts of the inclusion of micro-cap stocks in the analysis.

[Insert Table 9 here]

7.2.3 Industry-Adjusted Profitability-Growth Measures

Novy-Marx (2013) argues that firm profitability measures exhibit strong patterns related to the industry to which firms belong. To examine the extent to which our results are driven by these patterns, we repeat our two main analyses of cross-sectional predictability in stock returns, namely the double-sorted portfolio analysis (Table 4) and the Fama-MacBeth regressions with the full set of controls (Table 7), by demeaning our profitability-growth measure by industry medians. Results are reported in Internet Appendix Tables IA1 and IA2, respectively.

The economic and statistical significance of the PG effect and its variation across firm scale levels remains virtually identical to the ones reported with no industry adjustment. In line with our predictions P1 and P2, greater PG signals higher future stock returns, with the effect decreasing in firm scale, in both portfolio and regression industry-adjusted analyses. Moreover, the magnitude of these effects is remarkable similar with and without industry adjustment. We conclude that our findings are not driven by the potential differences in profitability patterns across industries.

8. Conclusion

In this paper, we offer a simple valuation framework to analyze the relationship between profitability growth and stock returns, and the effect of firm scale on this relationship, in the cross-section. By relating firm scale to the length of firms' abnormal growth periods in a two-stage valuation model, we demonstrate not only that firms with higher current profitability growth should earn higher expected returns, but also that the positive profitability growth-return relationship should decrease with the scale of the firm.

Empirically, we find that firm profitability growth is strongly persistent in the short term and that this persistence decreases with firm scale, rendering observed profitability growth and firm scale as suitable proxies for near-term expected profitability growth and (the inverse of) firms' abnormal profitability growth duration. Using these proxies, we provide empirical evidence in support of the testable implications of our framework, first using portfolio sorts, then using Fama-MacBeth cross-sectional regressions. In all our tests, regardless of weighting scheme, risk-adjustment of returns, or model specification, firms with high profitability growth earn higher subsequent returns, and this effect is reduced for larger firms. Additionally, larger firms earn lower stock returns only if their profitability growth is sufficiently high, with the effect reversing otherwise.

We document that the predictive strength of PG and its interaction with firm scale is distinct from preestablished relationships connecting returns to profitability levels, earnings surprises, or profits trends. Looking at longer holding periods, we find that the difference in the predictive effect of PG on the returns of small- versus large-scale firms grows with the investment horizon and does not mean revert, indicating that the near-term effects that we document are unlikely to be statistical anomalies. The results are not sensitive to different measures of firm scale, nor are they driven by the inclusion of small firms in our sample or by industry effects. Overall, our findings contribute novel insights and evidence on the cross-sectional relationship between firm profitability, scale, and stock returns.

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Appendix A: Variable definitions

Variable	Definition
Firm-level fundamentals (Source: Compustat)	
B/M	We follow the construction of book-to-market ratios in Fama-French (1992), who measure book equity at the fiscal year-end of the previous calendar year and define market equity as the market capitalization in December of the previous year. Book-to-market ratio is defined as book equity divided by market equity. Book equity is shareholder equity, plus deferred taxes, minus preferred stock (where available). Stockholders' equity is as given in Compustat data item (SEQ) (if available), or common/ordinary equity plus the carrying value of preferred stock (CEQ+PSTX) (if available), or total assets (AT) minus the sum of total liabilities and minority interest (LT+MIB). Deferred taxes are deferred taxes and investment tax credits (TXDITC), if available. Preferred stock is redemption value (PSTKR) (if available), or liquidating value (PSTKRL) (if available), or carrying value (PSTK). Market equity is lagged six months to avoid taking unintentional positions in momentum (Novy-Marx, 2013).
EM	Earning momentum is defined as the year-over-year changes of earnings before extraordinary items (IBQ) divided by book equity of the previous quarter. Book equity is shareholder equity, plus deferred taxes (TXDITCQ), minus preferred stock (PSTKQ) if it is available. Stockholders' equity is as given in Compustat item SEQQ, if available, or else common/ordinary equity (CEQQ) plus the carrying value of preferred stock (PSTKQ), if available, or else total assets(ATQ) minus total liabilities (LTQ).
Log(assets)	The logarithm of total assets (AT) plus 1.
Log(revenues)	The logarithm of revenues (REV) plus 1.
OP/B	Operating profitability is defined as operating profits divided by book equity. Operating profits are revenues (REVT) minus cost of goods sold (COGS), and selling, general and administrative expenses (XSGA), interest expenses (XINT). Book equity is shareholder equity, plus deferred taxes (TXDITC), minus preferred stock (PSTK) if it is available. Stockholders' equity is as given in Compustat item SEQ, if available, or else common/ordinary equity (CEQ) plus the carrying value of preferred stock (PSTK), if available, or total assets (AT) minus the sum of total liabilities and minority interest (LT+MIB).
PG	Profitability growth is defined as the year-over-year changes of operating profits divided by book equity of four quarters ago. Operating profits are revenues (REVTQ) minus cost of goods sold (COGSQ), and selling, general and administrative expenses (XSGAQ"), interest expenses (XINTQ). Book equity is shareholder equity, plus deferred taxes (TXDITCQ), minus preferred stock (PSTKQ) if it is available. Stockholders' equity is as given in Compustat item SEQQ, if available, or else common/ordinary equity (CEQQ) plus the carrying value of preferred stock (PSTKQ), if available, or else total assets (ATQ) minus total liabilities (LTQ).

SUE	Standardized earnings surprise assumes a seasonal random-walk model. Under this model, the standardized unexpected earnings (SUE) for month *t* are: $(eps_{i,q} - eps_{i,q-4}) / \sigma_{i,q}$ where $eps_{i,q}$ is the most recently announced earnings per share from Compustat quarter item, $eps_{i,q-4}$ is the matching earning per share lagged four quarters, and $\sigma_{i,q}$ is the standard deviation of $(eps_{i,q} - eps_{i,q-4})$ over the prior eight quarters.
SUE, Firm	The standardized earnings surprise measure at firm level is defined in the similar way as SUE except for using firm-level earnings (IBQ).
Trend	The profitability trend measure for firm *i* in quarter *q* is estimated in the following regression: $GP_{i,q}=a_{i,q}+\beta_{i,q}t+ \lambda_1 D_1+\lambda_2 D_2+\lambda_3 D_3+\varepsilon_{i,q},$ where GP is quarterly gross profits in levels defined as sales (SALEQ), minus quarterly cost of goods sold (COGSQ) scaled by total assets (ATQ); t=1,2,…,8, and represents a deterministic trend including the most recent eight quarters; D1 to D3 are defined as quarterly dummy variables to account for potential seasonality in gross profits. β is the estimated profitability trend measure.
Employees	The industry-adjusted number of employees (EMP) is defined as the number of employees of a firm minus the average of the number of employees of the industry (defined according to Fama & French 12 Industry Classification) that the firm belongs to.
Industry-adjusted PG	A firm's industry-adjusted PG is defined as PG minus the average of PG for all firms in a given industry that the firm belongs to
Financial variables (Source: the CRSP data)	
ME	Market equity is defined as absolute value of share price (PRC) times number of shares outstanding (SHROUT).
Market share	Market share is defined as a firm's market capitalization divided by the total market capitalization of the industry (defined according to Fama & French 12 Industry Classification) that the firm belongs to.
$r_{0,1}$	Returns in most recent month.
$r_{2,12}$	Prior one-year return, with a one-month skip
CAR	Cumulative abnormal returns are defined as the cumulative three-day abnormal returns relative to the market around earnings announcement (i.e., one day before the event to one day after).
Factor variables (Source: the Kenneth French data library)	
MKT	MKT is the monthly return to the market portfolio minus the monthly return of 30-day treasury bills.
SMB	SMB is the difference between the monthly returns on diversified portfolios of small and large stocks.
HML	HML is the difference between the monthly returns on a diversified portfolio of high and low B/M stocks.
UMD	UMD is the difference between the monthly returns on diversified portfolios of winners and losers.
RMW	RMW is the difference between the monthly returns on diversified portfolios with robust and weak profitability.
CMA	CMA is the difference between the monthly return on diversified portfolios of low- and high-investment firms.

Filing data (Source: EDGAR)	
10-K/Q filing date	10-K and 10-Q filing dates and CIK are extracted from SEC Edgar since 1993. We then use CIK to link with Compustat.

Appendix B: Proofs

Proof or Result R1

Define the function $F: \mathbb{R}^5 \to \mathbb{R}$ such that:

$$F(y, x_1, x_2, x_3, x_4) = \left(\frac{1+x_1}{r_{it}-x_1} - \left(\frac{1+x_1}{1+y}\right)^{x_2}\left(\frac{1+x_1}{y-x_1} - \frac{1+g}{y-g}\right)\right)x_3 - x_4.$$

Then it is easy to verify that F is continuously differentiable with respect to its 5 variables y, x_1, x_2, x_3, x_4. Let:

$$(y, x_1, x_2, x_3, x_4) = (r_i, g_i, T_i, YB_i, MB_i)$$

be a solution to $F(y, x_1, x_2, x_3, x_4) = 0$. If $\partial F(r_i, g_i, T_i, YB_i, MB_i)/\partial y \neq 0$, then by the Implicit Function Theorem, the equation $F(y, x_1, x_2, x_3, x_4) = 0$ can be locally solved at $(r_i, g_i, T_i, YB_i, MB_i)$ by an implicitly defined function $f: \mathbb{R}^4 \to \mathbb{R} \mid y = f(x_1, x_2, x_3, x_4)$ that is continuously differentiable, such that

$$r_i = f(g_i, T_i, YB_i, MB_i).$$

Moreover, the first order effects of (x_1, x_2, x_3, x_4) on y are given, for $k = 1, \ldots, 4$, by:

$$\frac{\partial f(g_i, T_i, YB_i, MB_i)}{\partial x_k} = -\frac{\partial F(r_i, g_i, T_i, YB_i, MB_i)/\partial x_k}{\partial F(r_i, g_i, T_i, YB_i, MB_i)/\partial y}.$$

We need to show that $\partial f(g_i, T_i, YB_i, MB_i)/\partial x_1 > 0$. We have:

$$\frac{\partial F(y, x_1, x_2, x_3, x_4)}{\partial y} = -\left(\frac{1+x_1}{(y-x_1)^2} - \left(\frac{1+x_1}{1+y}\right)^{x_2}\left(\frac{1+x_1}{(y-x_1)^2} - \left(1 - \frac{(y-g)(x_1-g)}{(1+g)(y-x_1)}x_2\right)\frac{1+g}{(y-g)^2}\right)\right)x_3,$$

so

$$\frac{\partial F(r_i, g_i, T_i, YB_i, MB_i)}{\partial y} = -\left(\frac{1+g_i}{(r_i-g_i)^2} - \left(\frac{1+g_i}{1+r_i}\right)^{T_i}\left(\frac{1+g_i}{(r_i-g_i)^2} - \left(1 - \frac{(r_i-g)(g_i-g)}{(1+g)(r_i-g_i)}T_i\right)\frac{1+g}{(r_i-g)^2}\right)\right)YB_i$$

For $g_i < g$, the expression multiplying $-YB_i$ on the RHS is positive, so the derivative has a negative sign. For $r_i > g_i > g$, a sufficient condition for the second term in the outer parenthesis of the RHS to be negative and smaller in absolute value than $(1+g_i)/(r_i-g_i)^2$ is that $(1+g)(r_i-g_i) > (r_i-g)(g_i-g)T_i$, so under this (mild) condition we conclude that $\partial F(r_i, g_i, T_i, YB_i, MB_i)/\partial y < 0$.

On the other hand, we have:

$$\frac{\partial F(y,x_1,x_2,x_3,x_4)}{\partial x_1} = \left(\frac{1+y}{(y-x_1)^2}\left(1-\left(\frac{1+x_1}{1+y}\right)^{x_2}\right) - x_2\left(\frac{1+x_1}{1+y}\right)^{x_2-1}\frac{x_1-g}{(y-x_1)(y-g)}\right)x_3$$
$$= \frac{1+y}{(y-x_1)^2}\left(1-\left(\frac{1+x_1}{1+y}\right)^{x_2}\left(1+\frac{(y-x_1)(x_1-g)}{(1+x_1)(y-g)}x_2\right)\right)x_3,$$

so

$$\frac{\partial F(r_i,g_i,T_i,YB_i,MB_i)}{\partial x_1} = \frac{1+r_i}{(r_i-g_i)^2}\left(1-\left(\frac{1+g_i}{1+r_i}\right)^{T_i}\left(1+\frac{(r_i-g_i)(g_i-g)}{(1+g_i)(r_i-g)}T_i\right)\right)YB_i.$$

We show that $F(r_i,g_i,T_i,YB_i,MB_i)/\partial x_1 > 0$ by contradiction. Suppose that, on the contrary, $F(r_i,g_i,T_i,YB_i,MB_i)/\partial x_1 < 0$. This is the case iff:

$$\left(\frac{1+g_i}{1+r_i}\right)^{T_i}\left(1+\frac{(r_i-g_i)(g_i-g)}{(1+g_i)(r_i-g)}T_i\right) > 1$$

$$\Leftrightarrow 1+\frac{(r_i-g_i)(g_i-g)}{(1+g_i)(r_i-g)}T_i > \left(\frac{1+r_i}{1+g_i}\right)^{T_i}$$

$$\Leftrightarrow \log\left(1+\frac{(r_i-g_i)(g_i-g)}{(1+g_i)(r_i-g)}T_i\right) > T_i\log\left(1+\frac{r_i-g_i}{1+g_i}\right).$$

To a first-order approximation (for small $r_i - g_i$), the LHS and the RHS of the last inequality are:

LHS: $\log\left(1+\frac{(r_i-g_i)(g_i-g)}{(1+g_i)(r_i-g)}T_i\right) \approx \frac{(r_i-g_i)(g_i-g)}{(1+g_i)(r_i-g)}T_i$;

RHS: $T_i\log\left(1+\frac{r_i-g_i}{1+g_i}\right) \approx \frac{r_i-g_i}{1+g_i}T_i$.

Thus, $\partial F(r_i,g_i,T_i,YB_i,MB_i)/\partial x_1 < 0$ iff:

$$\frac{(r_i-g_i)(g_i-g)}{(1+g_i)(r_i-g)}T_i > \frac{r_i-g_i}{1+g_i}T_i$$
$$\Leftrightarrow g_i > r_i,$$

contradicting our starting assumption that $g_i < r_i$. Hence, it must be that $\partial F(r_i,g_i,T_i,YB_i,MB_i)/\partial x_1 > 0$. We conclude then that:

$$\frac{\partial f(g_i,T_i,YB_i,MB_i)}{\partial x_1} = -\frac{\partial F(r_i,g_i,T_i,YB_i,MB_i)/\partial x_1}{\partial F(r_i,g_i,T_i,YB_i,MB_i)/\partial y} > 0.$$

Proof that cross-sectional differences in profitability growth have limited persistence in the two-stage dividend growth model

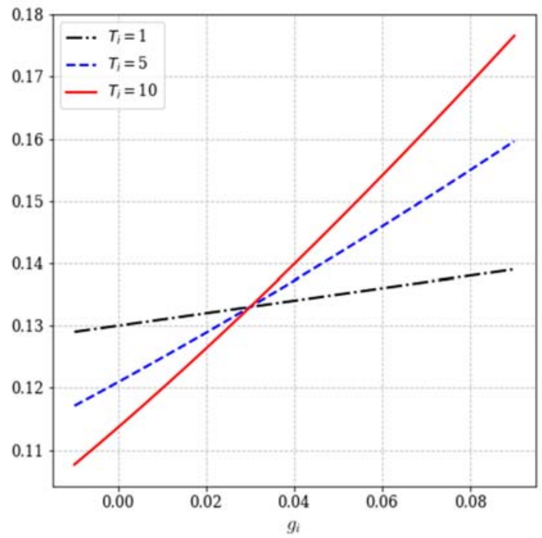
For $i \neq j,\ \tau > 0$, assume that $T_i = T_j = T$. We have:
$E\left[\left(g_{it+s}-g_{jt+s}\right)\left(g_{it+s+\tau}-g_{jt+s+\tau}\right)\right] = \begin{cases}(g_i-g_j)^2, & 0 < s+\tau \leq T \\ 0, & s+\tau > T\end{cases}.$

Similar calculations show that if $T_i \neq T_j$, $E\left[\left(g_{it+s} - g_{jt+s}\right)\left(g_{it+s+\tau} - g_{jt+s+\tau}\right)\right] \neq 0$ for $s + \tau \leq \max\{T_i, T_j\}$, but 0 otherwise.

Figure 1. Stock Returns in the Two-Stage Gordon Growth Model

This figure plots the required rate of stock return r_{it} that solves Eq. (2) as a function of the firm's expected near-term profitability growth g_i across different lengths T_i of the abnormal-growth period (Panel A), and as a function of the length T_i of the abnormal-growth period across different expected near-term profitability growth rates g_i (Panel B). The values of the remaining model parameters are typical and chosen to approximately match average values in our sample: $MB_{it} = 3.9$, $YB_{it} = 0.39$, $g = 0.03$.

Panel A



Panel B

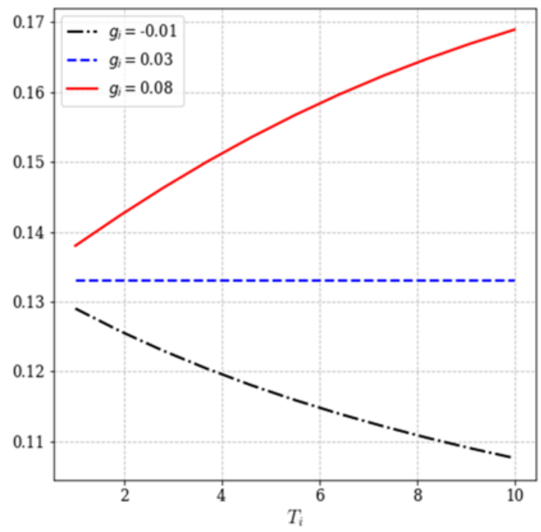


Figure 2: Firm Size and Profitability Growth Predictability

Each quarter, we rank NYSE, AMEX and NASDAQ stocks with share code of 10 or 11 on their firm's operating profitability growth and assign them to either one of three groups: Abnormally High PG (green squares), Abnormally Low PG (blue circles), or Normal PG (magenta triangles), depending on whether they rank in the top 30%, the bottom 30%, or the remaining 40% of the quarter's distribution. We then plot binned scatter plots of next-quarter profitability growth on firm (log) market capitalization (logME) by profitability-growth group following the methodology in Cattaneo et al. (2022). Following their recommended specification, the reported confidence intervals are based on cubic B-spline estimates of the regression function of interest. The sample period covers January 1975 to December 2019.

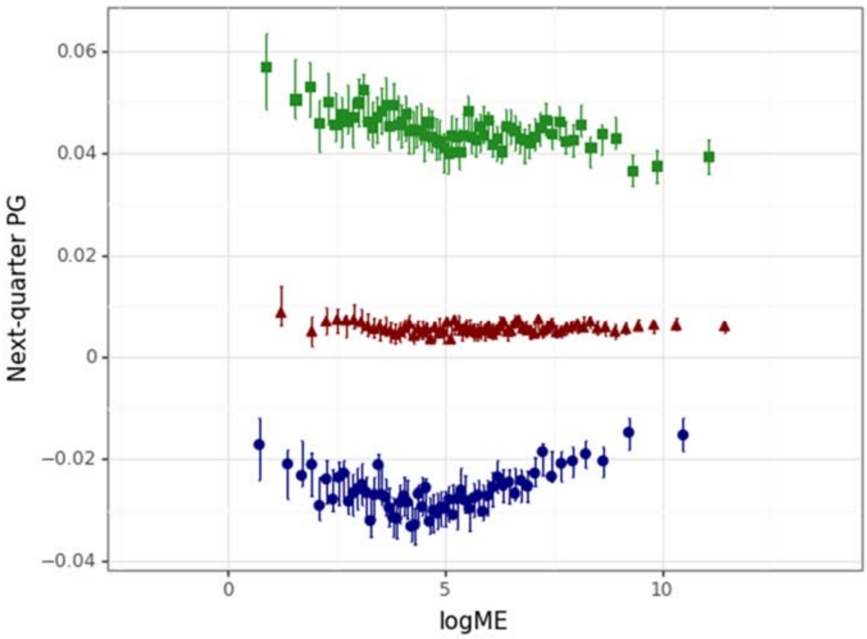
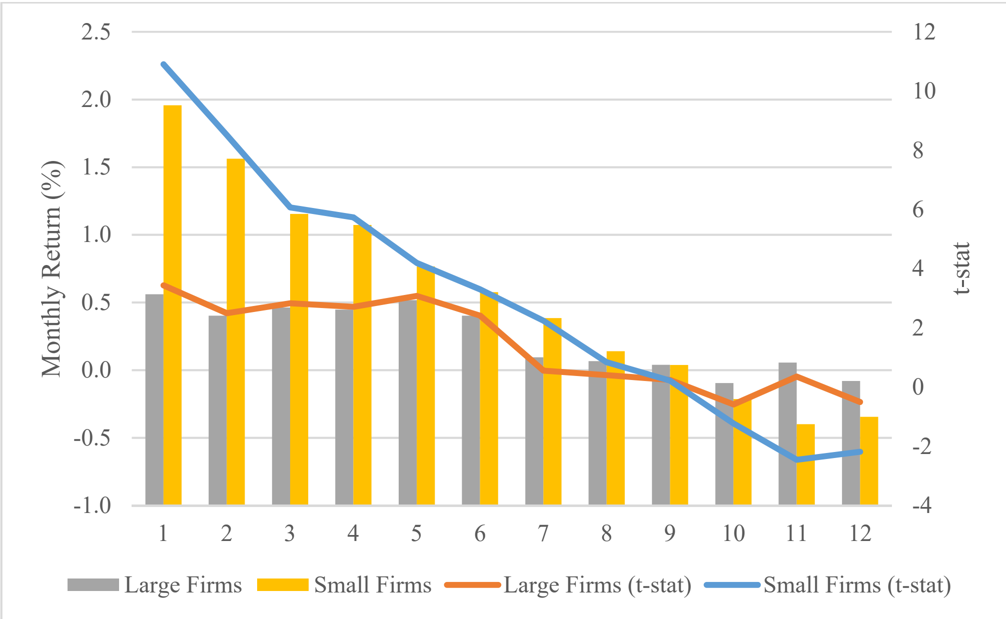


Figure 3: Monthly Returns to the Long-Short Profitability Growth Portfolios

In each month *t*, NYSE, AMEX and NASDAQ stocks with share code of 10 or 11 are sorted into decile portfolios based on the most recent quarter's operating profitability growth. The figure plots the value-weighted returns (bars) to the zero-investment Strong-minus-Weak profitability growth portfolio, which takes a long position in the highest operating-profitability-growth firms ("Strong") and a short position in the lowest operating-profitability-growth firms ("Weak") in month *t*+1, *t*+2,…, *t*+12 after portfolio formation in month *t*. Large Firms correspond to the top quintile of firm size, and Small Firms correspond to the bottom quintile of firm size. The sample period covers January 1975 to December 2019.

Panel A: Monthly Strong-Minus-Weak Returns



Panel B: Cumulative Strong-Minus-Weak Returns

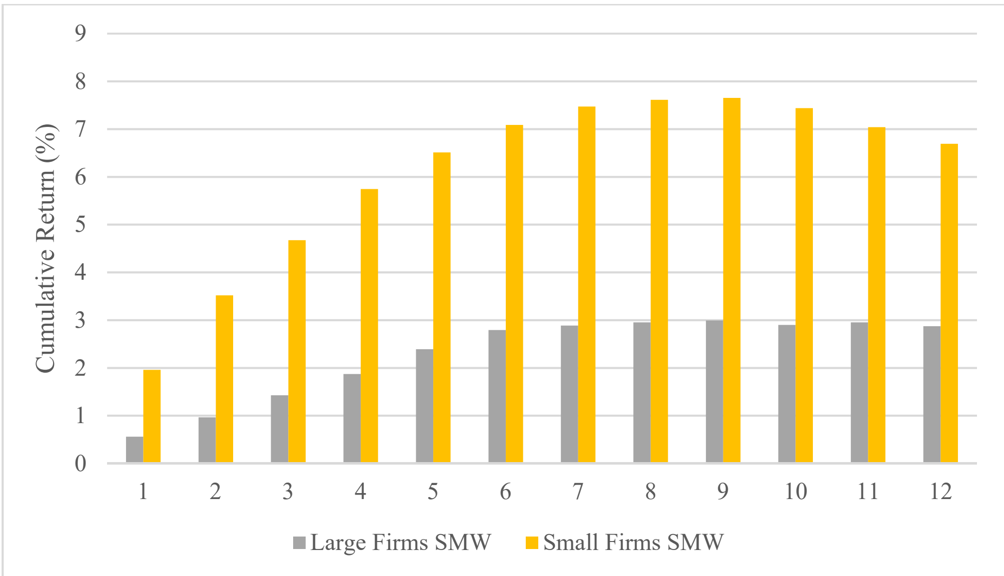


Table 1. Persistence of Cross-Sectional Profitability Growth Differences

Cross-sectional regressions are estimated at each fiscal quarter for profitability growth (PG) of firm *i* on its PGs of the prior one (-1), two (-2), …, eight (-8) quarters. The sample includes common stocks traded on the NYSE, AMEX and NASDAQ with coverage on the Center for Research in Security Prices (CRSP) and excludes Compustat. Financial firms (i.e., those firms with one-digit standard industrial classification codes of six). Variables are defined in Appendix A. The sample period spans from the first quarter of 1975 to the fourth quarter of 2019.

	Dependent Variable: PG				
	(1)	(2)	(3)	(4)	(5)
PG(-1)	0.52***	0.48***			
	(16.18)	(29.15)			
PG(-2)	0.11***		0.26***		
	(6.14)		(21.25)		
PG(-3)	0.00			0.08***	
	(0.17)			(7.38)	
PG(-4)	-0.38***				-0.18***
	(-21.24)				(-13.58)
PG(-5)	0.16***				
	(6.66)				
PG(-6)	0.04***				
	(4.04)				
PG(-7)	0.01				
	(1.42)				
PG(-8)	-0.10***				
	(-15.86)				
Adj-R^2	0.33	0.20	0.07	0.02	0.04

Table 2. Profitability Growth Persistence by Firm Scale Level

Ordinary least squares regressions of firms' average profitability growth (PG) over the subsequent *k* quarters, for *k* = 1, 2, 3, 4, 8, on current PG, firm scale, and their interaction, are estimated at each firm-profitability growth phase, defined as the set of consecutive quarters over which the firm's PG remains abnormally high, normal, or abnormally low. A firm's PG is classified as abnormally high, abnormally low, or normal, depending on whether the firm's operating profitability growth ranks in the top 30%, the bottom 30%, or the remaining 40% of the cross-sectional distribution as of the start of the profitability-growth phase. A firm is classified as large, small, or medium-sized, depending on whether it ranks in the top quintile, the bottom quintile, or the remaining three quintiles of the cross-sectional distribution of market capitalization as of the start of the profitability-growth phase. The dummy variable DPG_H (DPG_L) equals 1 if the firm belongs in the abnormally high (abnormally low) profitability-growth group, and 0 otherwise. The dummy variable DME_S (DME_M) equals 1 if the firm belongs in the small (medium) market capitalization group, and 0 otherwise. *t*-statistics based on heteroskedasticity-consistent (Huber/White sandwich estimator) standard errors are reported in parenthesis. The sample of firms and total time span is the same as in Table 1.

	Future Average PG over quarters [q + 1, q + *k*]				
	k = 1	*k* = 2	*k* = 3	*k* = 4	*k* = 8
DPG_L	-0.0190***	-0.0183***	-0.0128***	-0.00808***	-0.00314***
	(-21.40)	(-24.81)	(-18.16)	(-13.37)	(-7.82)
DPG_H	0.0245***	0.0215***	0.0187***	0.0137***	0.00751***
	(27.74)	(28.01)	(28.22)	(23.41)	(18.46)
DME_S	0.000552	0.000746	0.00089	-0.0000722	0.000614
	(0.67)	(1.05)	(1.4)	(-0.12)	(1.4)
DME_M	-0.00208***	-0.00236***	-0.00215***	-0.00247***	-0.00123***
	(-3.99)	(-5.17)	(-5.42)	(-6.93)	(-4.62)
DPG_L × DME_S	-0.0107***	-0.00781***	-0.00891***	-0.00278**	0.000286
	(-7.39)	(-6.56)	(-8.05)	(-2.81)	(0.4)
DPG_H × DME_S	0.00626***	0.00548***	0.00599***	0.00344***	0.000937
	(4.11)	(4.23)	(5.2)	(3.34)	(1.24)
DPG_L × DME_M	-0.00769***	-0.00645***	-0.00809***	-0.00502***	-0.00157**
	(-7.32)	(-7.40)	(-9.82)	(-7.00)	(-3.20)
DPG_H × DME_M	0.00410***	0.00330***	0.00321***	0.00248***	0.00125*
	(3.88)	(3.6)	(4.02)	(3.47)	(2.47)
Constant	0.00742***	0.00843***	0.00804***	0.00772***	0.00754***
	(16.97)	(21.97)	(24.56)	(26.64)	(35.27)
Adj-R^2	0.058	0.067	0.063	0.037	0.017

Table 3. Portfolio Characteristics by Profitability Growth Decile

This table shows summary statistics for ten portfolios sorted on profitability growth. At each month *t*, NYSE, AMEX and NASDAQ stocks with the share code of 10 or 11 are sorted into decile portfolios based on the most recent quarter's operating profitability growth (PG). The P10 portfolio consists of the highest operating-profitability-growth firms ("Strong"), while the P1 portfolio consists of the lowest operating-profitability-growth firms ("Weak"). The table presents the value-weighted book-to-market (B/M) ratio, operating profitability (OP/B), prior-year returns ($r_{2,12}$), and current-quarter operating profitability growth (PG_q). The sample period covers 1975 to 2019.

	ME	B/M	OP/B	$r_{2,12}$	PG_q
Weak	804	0.60	0.91	0.11	-0.26
2	1,342	0.66	0.41	0.06	-0.04
3	2,049	0.67	0.34	0.07	-0.02
4	2,943	0.66	0.33	0.10	-0.01
5	3,558	0.62	0.33	0.14	0.00
6	3,859	0.54	0.34	0.17	0.01
7	3,717	0.49	0.51	0.22	0.02
8	3,006	0.45	0.47	0.28	0.03
9	2,594	0.42	0.39	0.37	0.06
Strong	1,591	0.40	0.54	0.55	0.32

Table 4. Value-weighted Returns, by Firm Scale and Profitability Growth

Each month, we sort all stocks into quintile portfolios based on lagged market equity (i.e., Small, Middle-three quintiles, and Large). Within each size group, we additionally sort the stocks into quintiles based on profitability growth, from Weak (quintile 1) to Strong (quintile 5). This table reports value-weighted monthly unadjusted returns as wells as alphas from Fama and French factors (the market, size, value, profitability and investment factors MKT, SMB, HML, RMW, CMA) and the Carhart factors (the market, size, value and momentum factors, MKT, SMB, HML, MOM). *t* statistics are given in parentheses. LMS refers to the Large Minus Small market capitalization portfolio for a given PG quintile. SMW refers to the Strong Minus Weak PG portfolio for a given firm size group. The sample period covers 1975 to 2019.

	Small	Mid	Large	LMS	Small	Mid	Large	LMS
	Panel A: Unadjusted returns				Panel B: Fama-French 3-factor alpha			
Weak	0.20	0.77	0.93	0.73**	-1.23	-0.66	-0.18	1.05***
	(0.51)	(2.66)	(4.55)	(2.23)	(-5.96)	(-6.42)	(-2.10)	(4.70)
2	0.96	1.16	1.06	0.09	-0.35	-0.17	0.09	0.44**
	(2.75)	(5.04)	(6.17)	(0.31)	(-1.93)	(-2.44)	(1.50)	(2.31)
3	1.67	1.33	1.02	-0.65**	0.41	0.07	0.06	-0.36**
	(5.35)	(6.68)	(6.01)	(-2.36)	(2.66)	(1.09)	(0.95)	(-2.15)
4	2.39	1.57	1.01	-1.37***	1.01	0.27	0.07	-0.94***
	(6.65)	(7.35)	(5.11)	(-4.31)	(5.91)	(4.06)	(1.41)	(-5.10)
Strong	2.30	1.66	1.24	-1.06***	0.83	0.26	0.24	-0.59**
	(5.67)	(5.87)	(5.00)	(-2.96)	(3.34)	(2.77)	(3.06)	(-2.28)
SMW	**2.10*** **	**0.89*** **	**0.31** **	**-1.79*** **	**2.06*** **	**0.92*** **	**0.42*** **	**-1.65*** **
	(12.10)	**(5.67)**	**(2.14)**	**(-8.46)**	**(11.21)**	**(6.36)**	**(3.26)**	**(-7.30)**
	Panel C: Carhart 4-factor Alpha				Panel D: Fama-French 5-factor alpha			
Weak	-0.75	-0.38	-0.03	0.72**	-0.84	-0.35	-0.08	0.76***
	(-2.72)	(-4.42)	(-0.38)	(2.47)	(-2.72)	(-3.14)	(-0.85)	(2.60)
2	0.00	0.03	0.17	0.17	-0.11	-0.12	0.02	0.13
	(0.01)	(0.50)	(2.56)	(0.81)	(-0.49)	(-1.36)	(0.27)	(0.58)
3	0.64	0.16	0.05	-0.59***	0.51	-0.02	-0.05	-0.55***
	(3.75)	(3.07)	(0.99)	(-3.31)	(2.52)	(-0.25)	(-0.74)	(-2.59)
4	1.25	0.32	-0.01	-1.27***	1.17	0.21	0.01	-1.16***
	(6.29)	(4.74)	(-0.25)	(-5.84)	(5.78)	(3.17)	(0.13)	(-5.06)
Strong	1.14	0.27	0.11	-1.02***	1.10	0.30	0.28	-0.82**
	(4.10)	(2.71)	(1.59)	(-3.75)	(3.64)	(3.40)	(3.34)	(-2.58)
SMW	**1.89*** **	**0.66*** **	**0.14**	**-1.74*** **	**1.94*** **	**0.65*** **	**0.36*** **	**-1.58*** **
	(8.57)	**(4.96)**	**(1.29)**	**(-7.20)**	**(9.04)**	**(4.66)**	**(2.59)**	**(-6.38)**

Table 5. Fama-MacBeth Regressions, Controlling for Profitability Levels

Cross-sectional regressions are estimated for individual monthly stock returns on profitability growth (PG), profitability levels (OP/B), log of market equity (log(ME)), and the interaction of PG and log(ME). The control variables include the log of book-to-market ratio (log(B/M)), prior one-month return ($r_{0,1}$), and prior one-year return, with a one-month skip ($r_{2,12}$). Independent variables are trimmed at the 0.5% and 99.5% levels. The reported statistics are the means of the time series of coefficients estimated from the month-by-month regressions. Corresponding Newey-West (1987) *t*–statistics adjusted for heteroscedasticity and autocorrelations up to 3 lags are reported in parentheses. The sample period covers 1975 to 2019.

	(1)	(2)	(3)	(4)
PG		**4.73*** **	**4.96*** **	**9.93*** **
		(12.53)	**(13.29)**	**(10.41)**
PG × log(ME)				**-1.04*** **
				(-6.02)
OP/B	0.67***		0.81***	0.84***
	(4.02)		(4.82)	(4.95)
log(B/M)	0.30***	0.29***	0.34***	0.32***
	(3.76)	(3.78)	(4.20)	(4.07)
log(ME)	-0.10***	-0.07*	-0.10***	-0.10***
	(-2.77)	(-1.87)	(-2.87)	(-2.75)
$r_{0,1}$	-4.37***	-4.46***	-4.61***	-4.67***
	(-9.13)	(-9.26)	(-9.62)	(-9.78)
$r_{2,12}$	0.47**	0.30	0.23	0.23
	(2.10)	(1.31)	(1.03)	(1.04)
Adj-R^2	3.88	3.68	4.05	4.16

Table 6. Fama-MacBeth Regressions, Controlling for Earnings Surprises

Cross-sectional regressions are estimated for individual monthly stock returns on profitability growth (PG), profitability levels (OP/B), log of market equity (log(ME)), and the interaction of PG and log(ME). The control variables include earnings surprises measures (ES), the log of book-to-market ratio (log(B/M)), prior one-month return ($r_{0,1}$), and prior one-year return, with a one-month skip ($r_{2,12}$). The earnings surprises measures include cumulative abnormal returns (CAR) around earnings announcements dates, standardized unexpected earnings (SUE), standardized unexpected earnings at firm level (SUE, Firm), and earnings momentum (EM). Independent variables are trimmed at the 0.5% and 99.5% levels. The reported statistics are the means of the time series of coefficients estimated from the month-by-month regressions. Corresponding Newey-West (1987) *t*–statistics adjusted for heteroscedasticity and autocorrelations up to 3 lags are reported in parentheses. The sample period covers 1975 to 2019.

	ES = CAR		ES = SUE		ES = SUE, Firm		ES = EM	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PG		**8.76*****		**9.74*****		**12.79*****		**11.03*****
		(8.57)		**(8.49)**		**(9.75)**		**(8.69)**
PG × log(ME)		**-0.88*****		**-1.38*****		**-1.66*****		**-1.05*****
		(-4.47)		**(-6.01)**		**(-6.25)**		**(-4.24)**
ES	6.26***	5.73***	0.41***	0.35***	0.33***	0.24***	6.67***	3.32***
	(16.76)	(15.74)	(15.89)	(13.86)	(13.40)	(10.34)	(8.15)	(4.21)
OP/B	0.62***	0.75***	1.02***	1.13***	0.85***	1.02***	0.88***	0.96***
	(3.54)	(4.25)	(5.11)	(5.55)	(4.21)	(5.04)	(4.41)	(4.76)
log(B/M)	0.26***	0.28***	0.42***	0.41***	0.38***	0.36***	0.31***	0.31***
	(3.15)	(3.36)	(4.74)	(4.61)	(4.19)	(4.03)	(3.64)	(3.68)
log(ME)	-0.10***	-0.10***	-0.13***	-0.13***	-0.13***	-0.12***	-0.10***	-0.10***
	(-2.70)	(-2.73)	(-3.53)	(-3.42)	(-3.62)	(-3.39)	(-2.79)	(-2.72)
$r_{0,1}$	-5.40***	-5.61***	-4.89***	-5.06***	-5.00***	-5.21***	-4.79***	-5.04***
	(-10.76)	(-11.16)	(-9.86)	(-10.26)	(-10.36)	(-10.86)	(-9.60)	(-10.11)
$r_{2,12}$	0.29	0.10	-0.10	-0.17	0.11	-0.01	0.25	0.10
	(1.34)	(0.45)	(-0.41)	(-0.75)	(0.53)	(-0.07)	(1.15)	(0.45)
Adj-R^2	4.14	4.44	4.39	4.69	4.35	4.74	4.27	4.60

Table 7. Fama-MacBeth Regressions, Controlling for Profit Trend

Cross-sectional regressions are estimated for individual monthly stock returns on profitability growth (PG), profitability levels (OP/B), log of market equity (log(ME)), and the interaction of PG and log(ME). The control variables include trend, earnings surprises measures (ES), the log of book-to-market ratio (log(BM)), prior one-month return ($r_{0,1}$), and prior one-year return, with a one-month skip ($r_{2,12}$). Independent variables are trimmed at the 0.5% and 99.5% levels. The earnings surprises measures include cumulative abnormal returns (CAR) around earnings announcements dates, standardized unexpected earnings (SUE), standardized unexpected earnings at firm level (SUE, Firm), and earnings momentum (EM). The reported statistics are the means of the time series of coefficients estimated from the month-by-month regressions. Corresponding Newey-West (1987) *t*–statistics adjusted for heteroscedasticity and autocorrelations up to 3 lags are reported in parentheses. The sample period covers 1975 to 2019.

	Panel A: No ES		Panel B: Controlling for ES			
			CAR	SUE	SUE, Firm	EM
	(1)	(2)	(3)	(4)	(5)	(6)
PG		**15.81*****	**14.14*****	**14.16*****	**14.94*****	**13.51*****
		(12.60)	**(10.41)**	**(8.37)**	**(10.85)**	**(9.57)**
PG×log(ME)		**-1.62*****	**-1.41*****	**-1.92*****	**-1.95*****	**-1.37*****
		(-6.75)	**(-5.26)**	**(-6.06)**	**(-6.98)**	**(-5.03)**
Trend	6.03***	0.44	-1.41	-2.68	-0.44	-1.59
	(5.06)	(0.36)	(-1.05)	(-1.26)	(-0.19)	(-1.12)
ES			5.28***	0.31***	0.24***	3.61***
			(12.64)	(11.99)	(10.13)	(4.36)
OP/B	0.93***	1.11***	0.96***	1.12***	1.14***	1.05***
	(4.48)	(5.31)	(4.34)	(4.54)	(5.12)	(4.66)
log(BM)	0.28***	0.33***	0.29***	0.37***	0.35***	0.31***
	(3.23)	(3.74)	(3.31)	(4.09)	(3.82)	(3.53)
log(ME)	-0.11***	-0.10***	-0.10***	-0.13***	-0.12***	-0.11***
	(-3.03)	(-2.87)	(-2.79)	(-3.46)	(-3.40)	(-3.02)
$r_{0,1}$	-4.63***	-5.06***	-5.86***	-5.17***	-5.35***	-5.06***
	(-9.89)	(-10.73)	(-11.69)	(-10.32)	(-11.43)	(-10.06)
$r_{2,12}$	0.42*	0.09	-0.02	-0.18	-0.09	0.03
	(1.90)	(0.41)	(-0.09)	(-0.78)	(-0.41)	(0.13)
Adj-R^2	4.11	4.54	4.85	5.08	4.93	4.82

Table 8. Fama-MacBeth Regressions, Alternative Firm Scale Proxies

Cross-sectional regressions are estimated for individual monthly stock returns on profitability growth (PG), profitability levels (OP/B), log of firm size (FS), and the interaction of PG and FS. The control variables include trend, earnings surprises measures (ES), the log of book-to-market ratio (log(B/M)), prior one-month return ($r_{0,1}$), and prior one-year return, with a one-month skip ($r_{2,12}$). The firm size measures are log of revenues plus 1 in Panel A, log of total assets plus 1 in Panel B, log of book equity plus 1 in Panel C, market share in Panel D, and number of employees in Panel E. Independent variables are trimmed at the 0.5% and 99.5% levels. The reported statistics are the means of the time series of coefficients estimated from the month-by-month regressions. Corresponding Newey-West (1987) *t*–statistics adjusted for heteroscedasticity and autocorrelations up to 3 lags are reported in parentheses. The sample period covers 1975 to 2019.

	Panel A: FS=Revenue		Panel B: FS=Total assets		Panel C: FS=Book equity		Panel D: FS=Market share		Panel E: FS=Num. Employees	
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)
PG	**12.48*** **	**11.72*** **	**13.32*** **	**12.39*** **	**11.35*** **	**10.72*** **	**8.07*** **	**5.78*** **	**7.85*** **	**5.34*** **
	(6.34)	**(5.87)**	**(6.53)**	**(6.10)**	**(6.53)**	**(6.12)**	**(10.64)**	**(7.44)**	**(10.34)**	**(6.85)**
PG×FS	**-0.90*** **	**-1.33*** **	**-1.06*** **	**-1.45*** **	**-0.76** **	**-1.34*** **	**-2.60* **	**-4.06*** **	**-0.11*** **	**-0.15*** **
	(-2.67)	**(-3.93)**	**(-2.90)**	**(-4.07)**	**(-2.00)**	**(-3.64)**	**(-1.96)**	**(-3.30)**	**(-2.60)**	**(-3.41)**
Trend		-2.62		-2.64		-3.05		-3.20		-3.00
		(-1.19)		(-1.28)		(-1.46)		(-1.44)		(-1.36)
ES		0.32***		0.31***		0.32***		0.29***		0.29***
		(12.20)		(11.86)		(12.21)		(11.03)		(10.95)
OP/B	1.18***	1.16***	1.15***	1.13***	1.10***	1.07***	1.06***	1.00***	0.99***	0.92***
	(4.94)	(4.69)	(4.73)	(4.50)	(4.53)	(4.27)	(4.06)	(3.74)	(3.67)	(3.35)
log(B/M)	0.47***	0.55***	0.46***	0.53***	0.46***	0.53***	0.43***	0.50***	0.47***	0.55***
	(4.95)	(5.78)	(4.91)	(5.70)	(4.98)	(5.77)	(4.71)	(5.39)	(5.05)	(5.83)
FS	-0.11***	-0.12***	-0.12***	-0.13***	-0.12***	-0.13***	-0.01	-0.04	-0.00	-0.00
	(-3.26)	(-3.64)	(-3.56)	(-3.94)	(-3.16)	(-3.55)	(-0.22)	(-0.71)	(-0.86)	(-1.25)
$r_{0,1}$	-4.94***	-5.18***	-4.91***	-5.16***	-4.96***	-5.21***	-4.81***	-5.05***	-4.87***	-5.14***
	(-10.01)	(-10.36)	(-9.95)	(-10.33)	(-10.03)	(-10.41)	(-9.58)	(-9.94)	(-9.77)	(-10.15)
$r_{2,12}$	-0.09	-0.31	-0.07	-0.28	-0.07	-0.28	0.02	-0.18	-0.07	-0.28
	(-0.40)	(-1.37)	(-0.33)	(-1.25)	(-0.33)	(-1.25)	(0.10)	(-0.81)	(-0.32)	(-1.23)
Adj-R^2	4.67	4.97	4.73	5.00	4.80	5.08	4.03	4.30	4.03	4.32

Table 9. Fama-MacBeth Regressions, All-but-microcaps and Microcaps

Cross-sectional regressions are estimated for individual monthly stock returns on profitability growth (PG), profitability levels (OP/B), log of firm size (FS), and the interaction of PG and log(FS). The control variables include trend, earnings surprises measures (ES), the log of book-to-market ratio (log(B/M)), prior one-month return ($r_{0,1}$), and prior one-year return, with a one-month skip ($r_{2,12}$). In Panel A, micro firms are defined by using NYSE 20% breakpoints; in Panel B, micro firms are defined as the bottom 40% of all firms in the sample. Independent variables are trimmed at the 0.5% and 99.5% levels. The reported statistics are the means of the time series of coefficients estimated from the month-by-month regressions. Corresponding Newey-West (1987) *t*–statistics adjusted for heteroscedasticity and autocorrelations up to 3 lags are reported in parentheses. The sample period starts from 1975 to 2019.

	Panel A: NYSE 20% breakpoints		Panel B: 40% of all firms	
	All-but-micro	Micro	All-but-micro	Micro
	(1)	(2)	(3)	(4)
PG	**10.94****	**14.28*****	**14.22*****	**15.07*****
	(2.30)	**(3.45)**	**(4.08)**	**(3.12)**
PG×log(ME)	**-1.26***	**-2.98****	**-1.87*****	**-3.56****
	(-1.72)	**(-1.98)**	**(-3.31)**	**(-2.04)**
Trend	-1.13	-8.86*	-0.81	-10.18**
	(-0.43)	(-1.78)	(-0.32)	(-2.08)
ES	0.14***	0.58***	0.17***	0.70***
	(5.61)	(11.31)	(6.94)	(11.58)
OP/B	0.89***	0.90**	0.96***	0.81*
	(2.90)	(2.30)	(3.45)	(1.79)
log(BM)	0.40***	0.39***	0.36***	0.30*
	(3.79)	(2.85)	(3.73)	(1.90)
log(ME)	-0.05	-0.18**	-0.08**	-0.24**
	(-1.29)	(-2.19)	(-2.05)	(-2.31)
$r_{0,1}$	-3.79***	-5.96***	-3.79***	-5.94***
	(-6.85)	(-9.42)	(-6.98)	(-8.57)
$r_{2,12}$	-0.15	-0.36	-0.12	-0.39
	(-0.64)	(-1.40)	(-0.52)	(-1.44)
Adj-R^2	7.24	4.96	6.69	9.79

Internet Appendix

Table IA1. Value-weighted Returns, by Firm Scale and Industry-adjusted Profitability Growth

Each month, we sort all stocks into quintile portfolios based on lagged market equity (i.e., Small, Middle-three quintiles, and Large). Within each size group, we additionally sort the stocks into quintiles based on industry-adjusted profitability growth, from Weak (quintile 1) to Strong (quintile 5). This table reports value-weighted monthly unadjusted returns as wells as alphas from Fama and French factors (the market, size, value, profitability and investment factors MKT, SMB, HML, RMW, CMA) and the Carhart factors (the market, size, value and momentum factors, MKT, SMB, HML, MOM). *t* statistics are given in parentheses. LMS refers to the Large Minus Small market capitalization portfolio for a given PG quintile. SMW refers to the Strong Minus Weak PG portfolio for a given firm size group. The sample period covers 1975 to 2019.

	Small	Mid	Large	LMS	Small	Mid	Large	LMS
	Panel A: Unadjusted returns				Panel B: Fama-French 3-factor alpha			
Weak	0.24	0.79	0.93	0.69**	-1.18	-0.65	-0.15	1.03***
	(0.62)	(2.70)	(4.76)	(2.13)	(-5.81)	(-6.53)	(-1.78)	(4.61)
2	1.00	1.15	1.08	0.07	-0.32	-0.20	0.11	0.43**
	(2.79)	(4.99)	(6.42)	(0.22)	(-1.67)	(-2.95)	(1.71)	(2.13)
3	1.64	1.30	1.02	-0.62**	0.38	0.05	0.07	-0.31*
	(5.31)	(6.64)	(5.80)	(-2.33)	(2.42)	(0.74)	(1.47)	(-1.94)
4	2.31	1.60	1.08	-1.23***	0.95	0.31	0.11	-0.84***
	(6.75)	(7.57)	(5.59)	(-4.07)	(5.77)	(4.90)	(2.28)	(-4.60)
Strong	2.33	1.66	1.24	-1.09***	0.87	0.26	0.23	-0.63**
	(5.66)	(5.94)	(5.01)	(-3.08)	(3.44)	(2.98)	(3.05)	(-2.51)
SMW	**2.08*** **	**0.87*** **	**0.31** **	**-1.77*** **	**2.05*** **	**0.91*** **	**0.38*** **	**-1.66*** **
	(12.24)	**(6.59)**	**(2.19)**	**(-8.35)**	**(11.01)**	**(7.27)**	**(3.09)**	**(-7.23)**
	Panel C: Carhart 4-factor Alpha				Panel D: Fama-French 5-factor alpha			
Weak	-0.70	-0.40	-0.05	0.65**	-0.79	-0.36	-0.10	0.68**
	(-2.56)	(-4.60)	(-0.75)	(2.29)	(-2.57)	(-3.51)	(-1.30)	(2.32)
2	0.02	-0.00	0.18	0.16	-0.10	-0.14	0.06	0.16
	(0.07)	(-0.03)	(2.46)	(0.78)	(-0.43)	(-1.70)	(0.79)	(0.68)
3	0.64	0.13	0.04	-0.60***	0.47	-0.04	-0.05	-0.53**
	(3.69)	(2.46)	(0.79)	(-3.43)	(2.37)	(-0.63)	(-1.09)	(-2.49)
4	1.17	0.37	0.05	-1.13***	1.11	0.25	0.04	-1.07***
	(6.12)	(5.63)	(0.94)	(-5.32)	(5.61)	(4.07)	(0.73)	(-4.75)
Strong	1.17	0.30	0.15	-1.02***	1.15	0.32	0.32	-0.83***
	(4.27)	(3.18)	(2.12)	(-3.82)	(3.78)	(3.74)	(3.88)	(-2.73)
SMW	**1.88*** **	**0.69*** **	**0.20* **	**-1.67*** **	**1.93*** **	**0.68*** **	**0.42*** **	**-1.51*** **
	(8.48)	**(5.97)**	**(1.95)**	**(-6.84)**	**(8.88)**	**(5.74)**	**(3.51)**	**(-6.06)**

Table IA2. Fama-MacBeth Regressions: Industry-adjusted Profitability Growth

Cross-sectional regressions are estimated for individual monthly stock returns on industry-adjusted profitability growth (PG), profitability levels (OP/B), log of market equity (log(ME)), and the interaction of PG and log(ME). The control variables include trend, earnings surprises measures (ES), the log of book-to-market ratio (log(BM)), prior one-month return ($r_{0,1}$), and prior one-year return, with a one-month skip ($r_{2,12}$). Independent variables are trimmed at the 0.5% and 99.5% levels. The earnings surprises measures include cumulative abnormal returns (CAR) around earnings announcements dates, standardized unexpected earnings (SUE), standardized unexpected earnings at firm level (SUE, Firm), and earnings momentum (EM). The reported statistics are the means of the time series of coefficients estimated from the month-by-month regressions. Corresponding Newey-West (1987) *t*–statistics adjusted for heteroscedasticity and autocorrelations up to 3 lags are reported in parentheses. The sample period covers 1975 to 2019.

	Panel A: No ES		Panel B: Controlling for ES			
			CAR	SUE	SUE, Firm	EM
	(1)	(2)	(3)	(4)	(5)	(6)
PG		**12.69*** **	**12.30*** **	**11.57*** **	**13.24*** **	**12.50*** **
		(7.29)	**(8.43)**	**(6.72)**	**(8.46)**	**(9.02)**
PG×log(ME)		**-1.04*** **	**-1.05*** **	**-1.43*** **	**-1.73*** **	**-1.21*** **
		(-3.14)	**(-3.64)**	**(-4.37)**	**(-5.85)**	**(-4.62)**
Trend	3.21*	-1.72	-1.12	-2.94	-1.30	-1.65
	(1.80)	(-1.02)	(-0.83)	(-1.42)	(-0.59)	(-1.19)
ES			5.42***	0.32***	0.27***	4.05***
			(12.56)	(12.00)	(11.03)	(4.89)
OP/B	0.85***	1.05***	0.93***	1.05***	1.07***	1.07***
	(3.51)	(4.22)	(4.13)	(4.21)	(4.55)	(4.95)
log(BM)	0.27***	0.32***	0.29***	0.39***	0.37***	0.31***
	(3.03)	(3.42)	(3.30)	(4.18)	(4.01)	(3.54)
log(ME)	-0.12***	-0.13***	-0.12***	-0.15***	-0.14***	-0.13***
	(-3.25)	(-3.58)	(-3.40)	(-4.04)	(-3.82)	(-3.54)
$r_{0,1}$	-4.55***	-4.95***	-5.94***	-5.22***	-5.61***	-5.12***
	(-9.31)	(-9.99)	(-11.88)	(-10.32)	(-11.48)	(-10.32)
$r_{2,12}$	0.34	0.03	-0.05	-0.21	-0.11	0.04
	(1.49)	(0.15)	(-0.22)	(-0.91)	(-0.52)	(0.16)
Adj-R^2	4.40	4.91	4.86	5.10	4.93	4.81