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Predicting long-term earnings growth from multiple information sources

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ABSTRACT

While expected long-term earnings growth plays a pivotal role in valuation and investment applications, its common proxy, analysts' long-term growth forecasts (LTG), is well known for being over-optimistic. Guided by a stylized growth model, this paper uses three information sources to improve growth prediction—analysts' forecasts, stock prices, and financial statements. We find that the growth model using LTG, past earnings growth, the forward earnings-to-price ratio and past returns as predictors is unbiased and most accurate among the models considered in this paper. We further show that this growth prediction results in higher trading profits, more accurate equity predictions, and more reliable estimates of cost of equity. The findings suggest that this improvement in growth prediction leads to economically significant consequences in valuation and investment applications.

1. Introduction

Expected long-term earnings growth plays a pivotal role in valuation and investment applications. However, its common proxy, analysts' long-term growth forecasts (LTG), is well known for its optimism. In this paper, we seek to improve long-term earnings growth prediction by utilizing three sources of predictive information—analysts' forecasts, financial statements, and stock prices. We first evaluate different prediction models and identify an unbiased prediction specification with the highest accuracy. To demonstrate the economic consequences of improving the growth prediction, we next test whether the improved prediction is associated with more profitable trading strategies, more accurate intrinsic value estimation, and more reliable estimates of cost of equity.

Our study is motivated by two considerations. First, academic and practical applications both demand proxies for firms' expected long-term earnings growth. Examples in the academic literature include empirical implementations of valuation models (e.g., Frankel & Lee, 1998) and the estimation of cost of equity (e.g., Claus & Thomas, 2001; Gode & Mohanram, 2003). Analysts frequently cite long-term earnings growth prospects as a key justification for their stock recommendations or target prices (Bradshaw, 2002). A popular valuation ratio, the price-to-earnings-to-growth (PEG) ratio, requires a measure of expected long-term earnings growth as its key ingredient. In these applications, the quality of long-term earnings growth forecasts has direct consequences on the quality of valuation outcomes. Second, the commonly used long-term growth proxy – LTG issued by analysts – is well known for its drawbacks. It is shown to be highly upwardly biased, inaccurate, and to fail to fully incorporate public information (e.g., Chan, Karceski, & Lakonishok, 2003; Dechow, Hutton, & Sloan, 2000; Harris, 1999). LTG is even shown to be less accurate than the naïve time-series models (Harris, 1999). The poor quality of LTG inevitably affects the valuation applications relying on it. Therefore, improving the long-term growth prediction should have desirable implications for research and practice regarding equity valuation.

We adopt a strategy of utilizing multiple sources of information to predict long-term growth, which is different from prior studies that only use a single source (e.g., Brown, Hagerman, Griffin, and Zmijewski (1987) use time-series models; Abarbanell and Bushee (1997) use financial statements; Nekrasov and Ogneva (2011) use stock prices). Pooling information from multiple sources benefits prediction because information sources that are not perfectly correlated will jointly contribute to the prediction, leading to an outcome superior to that of each individual source alone (e.g., Fildes, 1991). Predicting long-term growth could particularly benefit from multiple information sources because long-term growth is highly uncertain and is affected by many factors, which any single information source is unlikely to cover entirely.

Devising a simple analytical model of earnings growth to conceptualize growth drivers, we identify three sources of predictive information. The first is analysts' forecasts. As one of their key professional activities, analysts devote considerable resources to analyzing firms and making long-term growth forecasts. Jung, Shane, and Yang (2012)

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present evidence that analysts issue LTG to signal their effort and ability, which suggest the usefulness of analysts' forecasts. The second source of predictive information is financial statements, which depict a firm's past operating, investing, and financing activities; such information bears implications for future earnings growth. The third source is stock prices. Stock prices embed information beyond analysts' forecasts and financial statements, and reflect investors' expectations of firms' long-term prospects (e.g., Hughes, Liu, & Su, 2008). Evidence shows that forward-looking information can be extracted from stock prices to improve earnings forecasts (e.g., Elgers & Murray, 1992; Nekrasov & Ogneva, 2011; Weiss, Naik, & Tsai, 2008).

Our empirical analysis proceeds in two parts. In the first part, we evaluate the prediction accuracy and bias of growth predictors using both in-sample and out-of-sample tests. The predictors include LTG, past growth, the forward earnings-to-price ratio (FEP), past returns, other price/return-based predictors, and financial statement variables such as capital expenditure, R&D, external financing, and dividend payouts. The out-of-sample results show that a quadri-variate model with LTG, FEP, past growth, and past returns as predictors significantly outperforms alternative models.

The second part of analysis examines the economic consequences of improving growth predictions. We obtain a growth prediction, G^*, from the best-performing model identified in the preceding analysis and use it in three applications: to construct trading strategies, to predict future equity value, and to estimate cost of equity. In the first application, we find that a trading strategy based on G^* yields higher hedge returns than a strategy based on LTG. The superior profitability of the G^* strategy is robust even after we control for LTG and common risk factors. In the second application, we find that the predicted one-year-ahead equity values based on G^* are more accurate and less biased than those based on LTG. In the third application, we find that the estimated cost of equity has a better quality when G^* substitutes LTG in the estimation: the estimated cost of equity based on G^* positively correlates with realized returns over the majority of the sample period, whereas the estimates based on LTG do so over less than half of the period. Taken as a whole, these findings indicate that our improved growth prediction produces significant economic consequences in valuation and investment applications.

In the supplemental analyses, we find that our growth models outperform LTG over the majority of the sample period. We also show that the improvement in the growth prediction varies with industry, and is significantly higher for small firms, firms with low analyst coverage, and glamor/value stocks.

This paper makes several contributions to the literature. First, this paper responds to the call for more research on long-term growth forecasts, which Ramnath, Rock, and Shane (2008) argue have high price impacts and yet are under-researched. Second, unlike prior studies that attempt to predict long-term growth from a single source, we utilize multiple sources of predictive information and evaluate a comprehensive list of growth predictors. Our results show that pooling information from multiple sources benefits the prediction of long-term growth. Third, we show that the improvement in the growth prediction can be exploited to yield higher trading profits, more accurate value predictions, and more reliable estimates of cost of equity. These findings reaffirm that the documented prediction improvement is not merely a matter of statistics but bears economically significant and sensible consequences for valuation and investment.

The remainder of the paper is organized as follows. We develop a growth model and explain methodology in Section 2. Data and sample are described in Section 3. Empirical results are presented and discussed in Section 4. Section 5 concludes.

2. Theoretical development and research design

In this section, we first develop a stylized model of earnings growth to conceptualize growth drivers. We then use the model's insights as a guide to develop our empirical methodology.

2.1. Development of a growth model

In a neo-classical setting, a firm uses a production process $f(\cdot)$ to convert a set of inputs $\mathbf{z}$ (with costs $\mathbf{w}$) to produce a product (or provide a service) with selling price π. The firm's earnings π is the difference between sales revenue and input costs:

$$p(\mathbf{z}; p, \mathbf{w}) = p \cdot f(\mathbf{z}) - \mathbf{w}'\mathbf{z}.$$

The firm's earnings growth rate is defined as

$$g_\pi = (d\pi/dt)/\pi.$$

We next specify model inputs to derive the earnings growth as a function of a set of economic drivers. To maintain parsimony, we consider two broad classes of inputs: (1) physical capital (k), such as working capital, equipment, and buildings; and (2) intangible capital (h), including human talents, brand names, patents, consumer basis, reputation, etc. The production utilizes both sets of inputs and takes the standard Cobb–Douglas form:

$$f(k, h) = Ak^a h^{1-a},$$

where $0 < \alpha < 1$ and A is a constant that captures technology.

Now the earnings growth rate g_π can be expressed as

$$g_\pi = f \cdot \dot{p} + \boldsymbol{\gamma}'\boldsymbol{\Omega}\mathbf{g}_z, \quad \text{(i)}$$

where

$$f \equiv Ak^a h^{1-a},$$
$$\dot{p} \equiv (dp/dt)/\pi,$$
$$\boldsymbol{\gamma} \equiv [(1-a)w_k a w_h],$$
$$\boldsymbol{\Omega} \equiv \begin{bmatrix} -k/\pi & 1/w_k + k/\pi \\ 1/w_h + h/\pi & -h/\pi \end{bmatrix},$$
$$\mathbf{g}_z \equiv [g_k g_h].$$

The right-hand side of Eq. (i) shows that earnings growth is driven by several drivers: (1) production or technology (f); (2) conditions in the product market ($\dot{p}$) and the supply market ($\boldsymbol{\gamma}$) (prices of the product and inputs are subject to numerous factors, including the interplay between the supply and demand, the competition level, and the firm's own market position); (3) existing capital ($\boldsymbol{\Omega}$); and (4) new investments ($\mathbf{g}_z$), captured by growth in both the physical and the intangible capital.

In light of Eq. (i), one may review the prediction of future earnings growth as a process to understand the *future* states of the growth drivers. In the rest of this section, we elaborate the key sources of predictive information that can be utilized to understand growth drivers and to facilitate growth prediction.

First, as Eq. (i) indicates, we need to gauge a firm's future technology (i.e., f) in order to predict earnings growth. Technology breakthrough is infrequent and the adoption of new technology is slow.[1] Over the five-year horizon considered in our paper, it is reasonable to expect that those established, mature, and stable firms are likely to retain their existing technology (with some incremental changes) and for them, future technology can be reasonably approximated by the existing technology. Because a firm's financial statements reflect its track records in past production and technology, analyzing trends in key variables in

[1] Comin and Hobijn (2010) show that, on average, it takes 45 years to adopt a technology worldwide after its invention.