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Rating to economic profit: Valuation properties, implementation issues, and the justification of target prices

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ABSTRACT

This study offers a comprehensive theoretical and empirical analysis of a fundamentals-based investment criterion (HSBC's Rating to Economic Profit – *REP*). By employing a large sample of US-listed firms over a 12-year time-period and conducting univariate, multivariate and portfolio analyses, we provide robust empirical results that support the ability of *REP* to explain contemporaneous stock market valuations, justify financial analysts' target prices, and predict one-year ahead stock returns. Through content analysis of selected financial analysts' equity research reports, we also provide some descriptive evidence of the usefulness of accrual accounting numbers over dividends for valuation purposes. To the best of our knowledge, this is the first academic study that offers a comprehensive analysis of *REP* as a value-based stock screening method that should be of interest to market-based accounting researchers, valuation educators, and capital market participants.

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1. Introduction

The purpose of this paper is to formalize the relation between price-to-book (*P/B*) and return on equity (*ROE*) in the framework of a practical yet sophisticated valuation technique that it is at the same time theoretically robust and easy to implement in practice. The Rating to Economic Profit (*REP*) is an investment analysis tool, developed by HSBC, to easily identify mispriced securities. In the current paper, we show how *REP* is derived from the Residual Income Valuation (*RIV*) model, discuss implementation issues, and offer extensions of the original formula. We also conduct a content analysis of selected equity research reports that employ variations of *REP* and assess the ability of this stock screening method to explain contemporaneous stock market valuations, justify financial analysts' target prices and predict future returns of stocks listed on the New York Stock Exchange (NYSE).

Academic interest has been stimulated by the role of the book-to-market ratio in multi-factor asset pricing models (Fama & French, 1992, 1993, 1996), the use of book value of equity as one of the core components of the residual income valuation model (Feltham & Ohslon, 1995; Ohlson, 1995), and the ability of *P/B* to predict future *ROE* (Beaver & Ryan, 2000). In recent years, Penman & Zhu (2022) use accounting information to create accounting-based asset pricing models, while Penman et al. (2018) support that, under specific circumstances, the book-to-market ratio is able to indicate the expected returns. The current study complements the literature that supports the

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usefulness of valuation models based on book value and *ROE* for the decision-making process of capital market participants (Imam et al., 2013).

By employing a large sample of US-listed firms over a 12-year time-period spanning from 2010–2021 and conducting univariate, multivariate and portfolio analyses, we provide robust empirical results that support the ability of *REP* to explain contemporaneous stock market valuations, justify financial analysts' target prices, and predict one-year ahead stock returns.

More particularly, we find that financial analysts issue relatively more (less) optimistic target prices for firms, which are considered undervalued (overvalued) based on *REP*'s corresponding values. Moreover, we conduct portfolio analysis and show that firms that are considered undervalued by the *REP* metric enjoy higher one-year forward stock returns compared to overvalued firms. Following, we provide estimates of the implied growth rates and cost of equity by reverse-engineering the alternative formulas of *REP*, and offer descriptive statistics on the proportions of US-listed firms that are considered either undervalued or overvalued by the application of *REP*. The target-price-implied growth rates stand at reasonably higher levels than the market-implied growth rates, which can be attributed to the financial analysts' optimism (Bradshaw et al., 2012b). Similarly, we observe lower target-price-implied cost of equity than market-implied cost of equity as the financial analysts' optimistic target price forecasts require lower estimates of cost of equity to be justified. By conducting content analysis of selected financial analysts' equity research reports, we provide descriptive evidence that provides further support for arguments that favour the use of accrual accounting numbers over dividends for value measurement purposes (Penman, 2013). Finally, we employ univariate and multivariate regression models to demonstrate that *REP* explains the contemporaneous stock market valuations of US-listed firms, and it constitutes a useful investment tool for financial analysts to derive their target price forecasts and predict one-year forward stock returns.

Although the relation between *P/B* and *ROE* is well-documented both in theory and practice (Wilcox, 1984; Fairfield, 1994; Beaver & Ryan, 2000, Demirakos et al., 2004), *REP* as an investment criterion is mostly ignored in theory. The current paper contributes to bridging this gap by offering a comprehensive discussion of *REP*'s valuation properties, practical implementation issues, and its use to justify financial analysts' target prices, explain the contemporaneous market pricing of the analysts' stock coverage universe, and predict future stock returns. Following this rationale, the current study's contribution is three-fold. First, it complements the prior literature on the use of book value and *ROE* for valuation purposes (Demirakos, et al. 2004; Imam, et al. 2013). Second, it adds to the well-established literatures on the target price properties (Bilinski et al., 2013; Bonini et al., 2010; Bradshaw et al., 2012a; Bradshaw et al., 2012b; Demirakos et al., 2010; Ho et al., 2018; Imam et al., 2013; Kerl, 2011 etc.) and the prediction of future stock returns by simplifying versions of *RIV* (Frankel and Lee, 1998; Lee et al. 1999). Third, it complements prior research studies that examine practical implementation issues of equity valuation models in the context of financial analysts' reports (Green et al. 2016; Hand et al. 2017).

Accounting research has been claimed to lack a practical implementation discussion that restricts the role of accounting research in the business world (Schrand, 2019). Schrand (2019) highlights the need for better information dissemination between academics and practitioners. Our study seeks to bridge this gap between accounting-based valuation theory and practice. Following this rationale, our theoretical and empirical analysis should be of interest to several constituents including: empiricists in the area of capital markets research in accounting, who can empirically assess the profitability of investment strategies based on a model that is used in practice by analysts; financial analysts, who might find useful and interesting a theoretical perspective on a practical valuation model; and valuation educators, who can complement their teaching of standard valuation methodologies with a sophisticated, yet easy to understand and use, valuation ratio.

The remainder of the current study is structured as follows. The next section offers a comprehensive literature survey of the relation between P/B and ROE, while the third section describes how *REP* can be derived from the residual income valuation model. The fourth section discusses practical implementation issues, such as the effects of accounting conservatism, the incurrence of losses and extraordinary (non-recurring) events, the impact of financial leverage, and the existence of considerable growth opportunities. It also provides illustrative examples of *REP*'s practical implementation drawn from financial analysts' equity research reports. The fifth section empirically assesses (with the use of portfolio analysis and univariate and multivariate regression models) the ability of financial analysts to employ *REP* in order to set their target prices, explain the contemporaneous market pricing of their stock coverage universe, and predict future stock returns. Finally, the last section offers some concluding remarks.

2. Literature review

The relation between the *P/B* and *ROE* has been of interest to researchers for a long time (Wilcox, 1984; Fairfield, 1994). Nevertheless, it is difficult to find a single-period valuation model that synthesizes *P/B* and *ROE* in a valuation formula that is theoretically robust and practically useful. The *P/B* ratio itself is considered a standard valuation model among researchers and practitioners in investment analysis, and its use is described in all the mainstream financial statement analysis textbooks (Lundholm & Sloan, 2017; Palepu et al., 2016; Penman, 2013).

Financial analysts almost always estimate *P/B* ratios, although they rarely rely on these as their primary valuation method for target price derivation, except for the analysis of banks and financial institutions (Imam et al, 2008). More often, analysts perform a joint analysis of *P/B* and *ROE* (Demirakos et al., 2004).[1] Imam et al. (2013) provide empirical support for the superiority of valuation models based on book value and *ROE* in terms of forecast accuracy. By conducting content analysis of a sample of financial analysts' equity research reports, Imam et al. (2013) show that a hybrid model *ROEg/COEg* (return to equity to cost of equity ratio, adjusted for growth) is very popular in the financial services/banking sector.

Apart from its role in asset pricing models, the academic literature on book-to-market (and *P/B*) is quite rich. Bernard (1994), Ryan (1995) and Beaver and Ryan (2000) assess the incremental information content of *P/B* for the prediction of future *ROE* beyond current *ROE*. Penman (1996) considers the effects of *ROE* and growth on *P/B* and price-to-earnings (*P/E*) ratios, while Penman (1998a) synthesizes these two valuation techniques and provides a basis to estimate fundamental value by using multiples on combined earnings and book values. Penman et al. (2007) examine the impact of financial leverage on the relationship between book-to-market and future stock returns. In subsequent studies, Penman and Reggiani (2013) interpret the book-to-market effect on future stock returns as an indication of the risk of overpaying for future growth in earnings, while Nezlobin et al. (2016) perform a structural mathematical analysis of the properties of *P/B* and *P/E* and model the effects of accounting conservatism, historical and predicted growth, and economic profitability on their values.

With respect to the relationship between *P/B* and *ROE*, Wilcox (1984) supports the use of a *P/B-ROE* regression line, where deviations from this linear model should be explained by changes in *ROE* or growth. Damodaran (2012) also supports the regression analysis of *P/B* on *ROE* as a method to further explore the mismatching between these two ratios. Fairfield (1994) states that *P/B* is an increasing function of the anticipated level of future *ROE*. Similarly, Barker (2001) and Penman (2013) claim that a firm with high (low) *P/B* should exhibit positive (negative) expected residual income – i.e. positive (negative) spread between expected *ROE* and cost of equity.

The above-described relation between market-to-book ratios and accounting rates of return is formalized within the framework of *REP*. In its original entity version, *REP* compares the enterprise value to invested capital (*EV/IC*) multiple to the ratio of return on invested capital to weighted average cost of capital (*ROIC/WACC*). The economic insights of this simple investment appraisal technique are straightforward, since comparing *REP* with critical cut-off values automatically generates a stock price recommendation. Following this rationale, if $REP > 1$, the stock is overvalued and its share price should fall, since its current market pricing cannot be justified by the firm's expected return spread; on the other hand, if $0 < REP < 1$, the stock is undervalued and its share price should rise to reflect the positive future prospects of the firm. In this sense, the use of *REP* as an investment screening method has the same critical benchmark value with the *PEG* (Price-Earnings to Growth) ratio.

This paper also complements the prior rich literature on target prices (Bilinski et al., 2013; Bonini et al., 2010; Bradshaw et al., 2012a; Bradshaw et al., 2012b; Demirakos et al., 2010; Ho et al., 2018; Imam et al., 2013; Kerl, 2011 etc.). Bradshaw (2002) provides some empirical evidence that analysts estimate their equity research reports' target prices by using heuristic valuation techniques, such as the *PEG* ratio. On the other hand, Gleason et al. (2013) find that the financial analysts' target prices, which appear to be based on sophisticated residual income valuation model specifications, tend to outperform those based on the simplistic *PEG* method. In this paper, we formally assess *REP*'s ability not only to justify financial analysts' target price boldness, but also to explain contemporaneous stock prices and to predict future stock returns – making in this way a significant contribution to the extant literature.

3. Derivation of REP from the Residual Income Valuation Model

Ohlson (1995) expresses the fundamental value of equity as equal to the current equity book value plus the present value of expected future residual income. The residual income is defined as forecasted earnings minus a capital charge that is equal to the equity book value times the cost of equity capital.

$$V_t = bv_t + \sum_{\tau=1}^{\infty} \frac{x^{\alpha}_{t+\tau}}{(1+r_e)^{\tau}} \tag{1}$$

where $x^{\alpha}_{t+\tau}$ is the forecasted residual income in period $t+\tau$.

Forecasted residual income can be expressed as equal to the difference between anticipated *ROE* and cost of equity times the equity book value. Hence, intrinsic value can be modeled as the current equity book value plus the present value of the return spread multiplied with the predicted book value of equity,

$$V_t = bv_t + \sum_{\tau=1}^{\infty} \frac{(ROE_{t+\tau} - r_e) \times bv_{t+\tau-1}}{(1+r_e)^{\tau}} \tag{2}$$

If the firm has reached a sustainable *ROE*, we can express the fundamental value of equity as equal to current book value plus the expected return spread times the current equity book value scaled by the cost of equity,

$$V_t = bv_t + \frac{(ROE_{t+1} - r_e) \times bv_t}{r_e} \tag{3}$$

Scaling the previous equation by current equity book value and performing some simple mathematical rearrangements produces the mathematical formula of *REP*,

$$\frac{V_t}{bv_t} = \frac{bv_t}{bv_t} + \frac{(ROE_{t+1} - r_e) \times bv_t}{r_e \times bv_t}$$

$$= 1 + \frac{ROE_{t+1} \times bv_t}{r_e \times bv_t} - \frac{r_e \times bv_t}{r_e \times bv_t} = \frac{ROE_{t+1}}{r_e}$$

$$\Rightarrow REP = \frac{MV_t}{V_t} = \frac{MV_t/bv_t}{ROE_{t+1}/r_e} \tag{4}$$

The value of *REP* equals one when the market values the stock correctly based on expected future economic performance. In such an efficient market, the gap between market and book value should be justified by the return spread between the firm's expected and required rate of return. The previous mathematical relationships reveal that *REP* can also be viewed as a market to fundamental value ratio, with the intrinsic value of equity being measured using a simplified version of the Residual Income Valuation (*RIV*) model. This practical version of the *RIV* method expresses the fundamental value as the sum of current book value of equity plus the capitalized value of next year's expected sustainable residual income. Hence, since in a competitive equilibrium setting, the *REP* ratio has a normal value of one, deviations from this cut-off value should denote market inefficiency and potential ways to generate abnormal returns by formulating investment strategies based on the particular fundamentals-based screening method. Frankel and Lee (1998) and Lee et al. (1999) find that a MV/V ratio, where V is based on the *RIV* model, has statistically significant predictive power of future stock returns.

4. Implementation issues

As said before, the use of *REP* for investment decision-making purposes is quite straightforward. The analyst should use four inputs, which can be obtained relatively easy (current book and market value of equity, cost of equity capital, and next-period's expected *ROE*), in order to assess the investment attractiveness of a stock. However, a number of factors may pose significant challenges to the analyst's valuation exercise: the effects of accounting conservatism; the incurrence of losses and extraordinary (non-recurring) events; the impact of financial leverage; and the existence of considerable growth opportunities. In the remainder of this section, we examine each of these four factors. In the last subsection, we also offer some illustrative examples from equity research reports of how financial analysts jointly analyse the *P/B* ratio and *ROE* to generate recommendations and target prices for the stocks they cover.

4.1 Accounting conservatism

Regarding accounting conservatism, we know that the accounting rate of return may be a biased estimate of the internal rate of return (Brealey et al., 2014). Conservative accounting methods (e.g., unrecorded goodwill, accelerated depreciation methods, expensing R&D and advertising expenditures, high allowances for doubtful accounts, etc.) understate the equity book value of the firm and increase its *P/B* ratio. However, at the same time, a firm that employs conservative accounting methods will exhibit higher accounting rates of return in the future (Penman, 2013). These two opposite effects on *REP* are partially offsetting each other causing a limited impact on the valuation of the firm. However, to fully control for accounting conservatism, an analyst may choose to undertake a number of accounting adjustments e.g., capitalization of R&D expenditures (Palepu, et al., 2016; Stewart, III 2013; Young & O'Byrne, 2001).

4.2 Loss-making firms / Non-recurring events

Regarding the incidence of losses and non-recurring events, the analyst should estimate a normalized (sustainable) earnings figure. Following this rationale, the formula of *REP* can be rewritten as,

$$REP = \frac{MV_t \times r_e}{ROE_{t+1} \times bv_t} = \frac{x^e_{t+1}}{x^s_{t+1}} \tag{5}$$

where x^e_{t+1} is expected economic earnings in period $t + 1$, and x^s_{t+1} is expected sustainable (permanent) earnings in period $t + 1$.

This equation shows that *REP* measures the ratio of investors' required earnings to the firm's actual earnings. In other words, it reflects the relation that exists between expected economic earnings (a market-based measure of profitability) and expected sustainable earnings (a fundamental measure of profitability).

The concept of economic earnings reflects the expected change in shareholders' wealth and can be thought as an alternative to the total shareholder return (*TSR*) metric of value creation.[2] The concept of sustainable earnings can be measured by either performing a number of adjustments to the actual earnings figure (Barker & Imam, 2008; Brown et al., 2015) or projecting the year that the firm will reach a sustainable level of earnings and computing *ROE* based on the discounted value of that year's expected earnings. The primary purpose of measuring earnings in the above fashion is to generate an income figure that better reflects and estimates value (Barth & Landsman, 2018; Black, 1980).

Following this rationale, *REP* compares firm's economic and sustainable performance, and suggests that a firm is overvalued (undervalued) if its expected economic earnings exceed (are less than) its sustainable earnings. *REP* assesses the extent of mispricing by reference to the expectations' gap between the investors' beliefs of the firm's expected economic profitability and the real potential of the firm to generate a sustainable level of performance.

4.3 Financial leverage

It is well-documented that a firm may be able to lever up its *ROE* by increasing its debt, if its operating return on assets is greater than its borrowing cost after tax (Halsey, 2001; Nissim & Penman, 2001). Furthermore, Penman (2013) shows that financial leverage may lead to a higher *P/B* if the enterprise *P/B* of the firm is above one. In empirical studies, Nissim and Penman (2003) investigate the effects of financial and operating liability leverage on future *ROE* and *P/B*, while Penman *et* al. (2007) find a positive (negative) association of the enterprise (leverage) component of book-to-market with future stock returns.

The above discussion reveals that the capital structure choices of the firm may have a considerable impact on the components of *REP*. Nevertheless, it is common practice in standard financial statement analysis textbooks (Lundholm & Sloan, 2017; Palepu et al., 2016; Penman, 2013) to distinguish between financial, operating and investing items in firms' financial statements based on the argument that it is the operating and investing activities that lead to value creation (Feltham and Ohlson, 1995).

Following this rationale, the equation below presents the entity version of *REP*, which uses the enterprise value to book value of invested capital as numerator and the return on invested capital divided by the weighted average cost of capital as denominator.[3]

$$REP = \frac{EV_t/IC_t}{ROIC_{t+1}/WACC} \tag{6}$$

where EV_t is the enterprise value of the firm at date t, IC_t is the book value of the invested capital at date t, $ROIC_{t+1}$ is the expected return on invested capital in the period $t+1$, and $WACC$ is the weighted average cost of capital.

4.4 Growth opportunities

Based on the Gordon Growth Model (*GGM*), if we assume a constant growth rate of dividends g, we can show that the fundamental value of equity can be expressed as (Gordon, 1962),

$$V_t = \frac{d_{t+1}}{r_e - g} \tag{7}$$

Substituting dividends with earnings x_{t+1} times one minus the earnings retention ratio b the above formula can be rewritten as,

$$V_t = \frac{x_{t+1} \times (1 - b)}{r_e - g} \tag{8}$$

Earnings are equal to return on equity times the equity book value, so the previous equation becomes,

$$V_t = \frac{ROE_{t+1} \times bv_t \times (1 - b)}{r_e - g} \tag{9}$$

Employing the formula of the sustainable growth rate $g = ROE_{t+1} \times b$ and performing some simple mathematical rearrangements, we can derive a modified version of the *REP* formula that incorporates a growth factor (Beaver & Ryan, 2000; Damoradan, 2012; Pinto et al., 2010).

$$V_t = bv_t \times \frac{ROE_{t+1} - g}{r_e - g} \Rightarrow$$

$$REP = \frac{MV_t/bv_t}{(ROE_{t+1} - g)/(r_e - g)} \tag{10}$$

The origins of this growth-adjusted *REP* formula are traced back to the debate on the usefulness of accounting rates of return as surrogates for the internal rate of return (Edwards et al., 1987). Kay (1976) uses integral analysis to show that the ratio of market-to-book is equal to,

$$\frac{MV}{bv} = \frac{g - ARR}{g - IRR} \tag{11}$$

where *ARR* is the accounting rate of return, and *IRR* is the internal rate of return.

By rearranging the above equation and replacing the internal rate of return with the investors' required rate of return (cost of equity capital), we can derive the modified version of the *REP* formula that incorporates a growth factor.[4]

4.5 Illustrative examples from equity research reports

In this subsection, we offer some illustrative examples of how financial analysts jointly analyse the *P/B* ratio and *ROE* to generate recommendations for the stocks they cover. We search the content of equity research reports, provided by the *Investext* database, to identify instances of uses of the previously described investment evaluation technique. *Investext* offers a comprehensive collection of equity research reports from U.S. and international investment brokerage houses. Recent academic studies that collect analysts' reports from *Investext* to explore the practical implementation of the *DCF* and *RIV* models include Green et al. (2016) and Hand et al. (2017).

In a HSBC's equity research report, Schramm and Siebrecht (2014) apply *REP* to examine the investment attractiveness of a German listed firm, named Duerr AG. They argue that the entity version of *REP*, which compares the enterprise value to invested capital multiple with the return on invested capital to the weighted average cost of capital ratio, controls for differences in the capital structure of the examined firms and periods with varying long-term interest rates. In their valuation exercise, they adjust the profitability measures for the effect of extraordinary items, while they also exclude from their calculations the impact of non-core assets.

In this respect, they believe that *REP* will be more likely to reflect true economic performance. They estimate the 2015E *EV/IC* multiple for Duerr AG as equal to 2.38, while the expected *ROIC/WACC* is equal to 2.30. Hence, Duerr's *REP* ratio stands at the level of 1.04, which indicates that the difference in the pricing of the firm, between enterprise value and invested capital, is fully explained by the ability of the firm to generate future abnormal profits. The analysts not only compare *REP* with its benchmark value of one, but also with its average values for the firm's industry peers. In this sense, they claim that Duerr AG trades at a 12–13% discount to comparable engineering and industrial firms, since the average *REP* values for these two sectors are at the levels of 1.18 and 1.19, respectively.

With respect to the modified *REP* formula that incorporates a growth factor, we notice that in many equity research reports financial analysts choose to implement the standard dividend-based Gordon Growth Model (*GGM*), by using accounting ratios and amounts, such as *ROE* and book value of equity. This finding is in line with Penman (2013), who argues that although "*equity value is based on future dividends, forecasting dividends over a finite horizon does not give an indication of value*". It seems that financial analysts need to predict something more fundamental than dividends when implementing the *GGM* (Penman & Sougiannis, 1997; Penman, 1998b; Pinto et al., 2010).

In a Deutsche Bank's equity research report, Lock (2015) claims that he employs the *GGM* to estimate a target price for a UK-listed firm, named Aldermore Group. He assumes a 2018E Return on Tangible Equity (*RoTE*) of 17%, a sustainable growth rate of 3% and a cost of equity capital equal to 10%. Based on these inputs, he calculates a fair *P/B* for Aldermore Group equal to 2, which he applies to his estimate of 2018E Tangible Net Asset Value (*TNAV*) of 198p. The fair value of 396p for Aldermore Group's stock in 2018E, is discounted back to 2016E to generate an implied 12-month target price of approximately 330p. In an additional equity research report by Barclays for European diversified financials, Garrod et al. (2015) use the *GGM* formula to implement a *P/B*-based valuation for a UK-listed firm, named OneSavings Bank, PLC. By using as inputs to the model a *ROE* of 25%, a growth rate of 3%, and a cost of equity capital of 10%, they estimate a justified *P/B* equal to 3.1. They apply this multiple to the bank's forecasted Shareholder Equity for fiscal year 2015, and they get an implied target price of 385p.

The modified *REP* formula is not only used as a separate model to value the company as a whole, but it may be employed within a Sum-of-the-Parts (*SOTP*) valuation methodology to estimate the value of the individual business segments of the firm. In a Credit Suisse equity research report, Green and Grobler (2016) identify three business units of Aggreko, a UK-listed firm. By using the modified *REP* formula that incorporates a growth factor they estimate an implied *EV/IC* multiple, which they apply to each segment's invested capital to arrive at the enterprise value of the segment. For example, for the fiscal year 2017, they value the Rental Solutions' business segment, by using a *ROIC* of 8.6%, a *WACC* of 6.5% and a sustainable growth rate of 3%. Following this rationale, they calculate an implied *EV/IC* equal to 1.6 as the ratio of 8.6% minus 3%, to 6.5% minus 3%. They multiply this ratio to the prospective invested capital of the segment, which is estimated at GBP 663 m to arrive at an enterprise value of Rental Solutions equal to GBP 1,061 m. They conduct the same *EV/IC* analysis for the other two segments. By adding the enterprise values of the three business segments, subtracting the net financial obligations of the firm and dividing with the average number of shares outstanding, they calculate an implied share price at the end of fiscal year 2017. They repeat this valuation exercise for fiscal years 2016 and 2018. By discounting back to the report's issuance date, the three fair values and calculating their average, they arrive at a target price for Aggreko, driven by an *EV/IC*-based *SOTP* valuation framework.

Finally, some analysts implement a dividend discount model, but use accounting amounts to estimate the terminal value at the end of the finite horizon (Nissim, 2019). In a Jefferies equity research report, Dickerson et al. (2015) discount the expected dividends of Standard Chartered PLC for the next three years and then implement the *GGM* formula to estimate the terminal value. They project a *RoTE* of 7.2%, a zero-growth rate, and a 12% cost of equity capital. Based on these inputs, the justified Price-to-Tangible Net Asset Value (*P/TNAV*) is approximately 0.60, which multiplied with a 2017E *TNAV* of 1,734 gives a terminal value of 1,039. The present value of the terminal value is estimated at 829, which accounts for 88.2% of the target price of 940. In other words, approximately 90% of the estimated value of this dividend discount model is based on accounting numbers.

5. Empirical analysis

In the following subsections, we conduct a formal empirical assessment of the association between *REP* and the financial analysts' target price optimism. We examine whether financial analysts issue more optimistic target prices for undervalued stocks with low *REP* ratios compared to overvalued stocks with high *REP* metrics. Similarly, we examine if the one-year forward stock returns of undervalued stocks with low *REP* ratios is higher than the one-year forward stock return of overvalued stocks with high *REP* metrics. Furthermore, we investigate whether pseudo target prices based on *REP* can explain current market prices and analysts' target prices with the use of *OLS* regression models. We additionally employ multivariate regression analysis to examine whether *REP* can predict one-year forward stock returns after controlling for a number of fundamentals-based financial ratios. Finally, we provide estimates of the implied growth rates and implied cost of equity by reverse-engineering the alternative *REP* specifications.

5.1 Data collection and empirical research design

We collect US data from Datastream via Thomson Reuters Eikon platform. We access the database by applying the filtering process that is presented in Table 1. We construct our sample in this way to include both active and dead / inactive US-based firms that are listed on New York Stock Exchange (NYSE). The total number of available equities in Datastream that meet our data selection criteria is 2,670. We restrict our sample to include only those firms that have fiscal year end dates from 20 December to 10 January.[5] This criterion leads to an exclusion of 441 US-listed firms. After applying these data collection criteria, we end up with a sample of 2,229 firms.

After constructing the above list of 2,229 US-listed firms, we collect the accounting and financial data that we need to calculate the values of *REP* and *TP/P* (I/B/E/S Target Price Mean, *PTMN*, to I/B/E/S Price, *IBP*)[6] ratios for our sample firms. Table 2 offers a detailed description of the variables'

Table 1. Data collection process.

Panel A. Data Collection Criteria	**Number of Firms**
Initial Number of Firms	2,670
(-) Number of firms that do not have a fiscal year-end date between December 20 and January 10	(441)
Final Number of Sample Firms	**2,229**

Panel B. Data from 2010 to 2021

		Missing Values				
Variables	**Initial Number of Observations**	**Non-Available Information**	**Negative *P/B***	**Negative *ROE***	**Negative *REP***	**Number of Observations in Final Sample**
REP_1	19,035	5,981	601	944	-	11,509
REP_2	19,035	5,981	601	944	-	11,509
REP_3	19,035	5,981	601	944	704	10,805
REP_4	19,035	5,981	601	944	860	10,649
REP_5	19,035	5,981	601	944	-	11,509
REP_6	19,035	5,981	601	944	704	10,805
TP/P	19,035	7,468	-	-	-	11,567

Note: The Table describes our data collection process. We apply a filtering process on Thomson Reuters Eikon platform (Datastream) so as to restrict our initial sample to include equities from active and dead / inactive firms that are listed on "NYSE" and their financials are expressed in US$. Our initial sample consists of 2,670 US-listed firms. To end up to a final sample of 2,229 firms, we exclude firms that do not have fiscal year end dates between 20 December and 10 January (approx. similar to the calendar year end date). The initial number of firm-year observations in our sample is 19,035. We have some missing values due to the limited availability of data (*ROE*, *P/B*, *TP/P*). We also choose to restrict our sample by excluding firm-year observations with negative Price-to-Book (*P/B*) and Return-on-Equity (*ROE*) ratios. After *REP*'s calculations, we further exclude all negative values of this ratio that are due to low *ROE* compared to growth (in cases where g= 2.936 percent). In this way, we end up with a final sample that ranges from 10,649 to 11,509 firm-year observations for our four *REP* metrics and 11,567 values for *TP/P* (see last Column, Panel B). Variable definitions are provided in Table 2.

definitions. We collect all our price-related data on 1 April of the subsequent year due to the 10-K form SEC filing requirements of 90 days after the end of the company's fiscal year. We collect data for 12 years from 2010 to 2021. This process leads to an initial sample of 19,035 firm-year observations.

The limited availability of data for *REP* and *TP/P* estimation further decreases our sample by 5,981 missing observations for each *REP* specification and 7,468 missing observations for the *TP/P* boldness measure. Finally, we exclude all firm-year observations in our sample that have negative *ROE*, *P/B* and *REP* values, since *REP* and *TP/P* ratios can take only positive values to have a

Table 2. Variable definitions.

Variable name	Variable definition
dREP_1	A dummy variable that takes the value of 1 when *REP_1* > 1 and the value of zero when 0 < *REP_1* < 1.
dREP_2	A dummy variable that takes the value of 1 when *REP_2* > 1 and the value of zero when 0 < *REP_2* < 1.
dREP_3	A dummy variable that takes the value of 1 when *REP_3* > 1 and the value of zero when 0 < *REP_3* < 1.
dREP_4	A dummy variable that takes the value of 1 when *REP_4* > 1 and the value of zero when 0 < *REP_4* < 1.
dREP_5	A dummy variable that takes the value of 1 when *REP_5* > 1 and the value of zero when 0 < *REP_5* < 1.
dREP_6	A dummy variable that takes the value of 1 when *REP_6* > 1 and the value of zero when 0 < *REP_6* < 1.
g	Long-term growth rate; it is defined as the long-term (average) US GDP real growth rate (*USWD3QBGR*) from 1961 to 2021.
g_{sp}	The market-implied growth rate from *REP* ratio.
g_{tp}	The target-price-implied growth rate from *REP* ratio.
ROE	Return-on-Equity defined as 12-month Forward Earnings Per Share (*EPS1FD12*) on 1 April of the subsequent year, divided by the Common Equity (*WC03501*) at the fiscal year end date. The Common Equity is scaled by the Number of Common Shares Outstanding (*WC05301*) to produce the book value per share.
Ri	One-year forward stock return is calculated as the one-year forward percentage change of the Return Index (*RI*).
r_{CAPM}	Cost of Equity is calculated from Fama and French (1997) as industry-specific risk premiums plus the risk-free rate. We use the 10-Year Treasury bond yield (*USYIETBNR*) on 1 April of the subsequent year as the risk-free rate and the full-period CAPM-based industry-specific risk premiums (from Fama and French, 1997).
r_{tf}	Cost of Equity is calculated from Fama and French (1997) as industry-specific risk premiums plus the risk-free rate. We use the 10-Year Treasury bond yield (*USYIETBNR*) on 1 April of the subsequent year as the risk-free rate and the Three-Factor-model-based industry-specific risk premiums (from Fama and French, 1997).
r_1	The market-implied cost of equity from the *REP* ratio that assumes zero future growth.
r_2	The market-implied cost of equity from the *REP* ratio that assumes a constant future growth rate g.
r_3	The target-price-implied cost of equity from the *REP* ratio that assumes zero future growth.
r_4	The target-price-implied cost of equity from the *REP* ratio that assumes a constant future growth rate g.
REP	In all *REP* specifications, the numerator of the ratio is defined as equal to the Market Value (*MV*) on 1 April of the subsequent year to the book value of Common Equity (*WC03501*) at the company's fiscal year end date. The expected Return on Equity (*ROE*) and the cost of equity estimates in the denominator of all ratios are defined above. The *REP* formulas are described in Section 4.
REP_1	In this *REP* specification, we do not take into consideration future growth prospects. We use r_{CAPM} as cost of equity.
REP_2	In this *REP* specification, we do not take into consideration future growth prospects. We use r_{tf} as cost of equity.
REP_3	In this *REP* specification, we incorporate a growth factor g. We use r_{CAPM} as cost of equity.
REP_4	In this *REP* specification, we incorporate a growth factor g. We use r_{tf} as cost of equity.
REP_5	In this *REP* specification, we do not take into consideration future growth prospects. We use $r_e = 9$ percent as cost of equity.
REP_6	In this *REP* specification, we incorporate a growth factor g. We use $r_e = 9$ percent as cost of equity.
TP/P	Target Price-to-Price ratio is defined as the I/B/E/S Target Price Mean (*PTMN*) to I/B/E/S Price (*IBP*).
$Pseudo - TP_1$	The pseudo target price from the *REP* ratio that ignores future growth opportunities and employs r_{CAPM} as the cost of equity.
$Pseudo - TP_2$	The pseudo target price from the *REP* ratio that ignores future growth opportunities and employs r_{tf} as the cost of equity.
$Pseudo - TP_3$	The pseudo target price from the *REP* ratio that assumes a constant future growth rate and uses the cost of equity r_{CAPM}.
$Pseudo - TP_4$	The pseudo target price from the *REP* ratio that assumes a constant future growth rate and uses the cost of equity r_{tf}.
$Pseudo - TP_5$	The pseudo target price from the *REP* ratio that ignores future growth opportunities and employs $r_e = 9$ percent as the cost of equity.
$Pseudo - TP_6$	The pseudo target price from the *REP* ratio that assumes a constant future growth rate and uses the cost of equity of $r_e = 9$ percent.

Note: All data are from Datastream and their datatypes are given in parentheses.

meaningful explanation. Our final sample of firm-year observations ranges from 10,649 to 11,509 for the six variations of the *REP* metric (see Table 1).

We use the following six alternative specifications of the equity version of the *REP* formula to increase the rigorousness and robustness of our empirical work:

$$REP_1 = \frac{MV_t/bv_t}{ROE_{t+1}/r_{CAPM}} \tag{12}$$

$$REP_2 = \frac{MV_t/bv_t}{ROE_{t+1}/r_{tf}} \tag{13}$$

$$REP_3 = \frac{MV_t/bv_t}{(ROE_{t+1} - g)/(r_{CAPM} - g)} \tag{14}$$

$$REP_4 = \frac{MV_t/bv_t}{(ROE_{t+1} - g)/(r_{tf} - g)} \tag{15}$$

$$REP_5 = \frac{MV_t/bv_t}{ROE_{t+1}/r_e} \tag{16}$$

$$REP_6 = \frac{MV_t/bv_t}{(ROE_{t+1} - g)/(r_e - g)} \tag{17}$$

In all *REP* specifications, the numerator of the ratio is defined as equal to the Market Value (*MV*) on 1 April of the subsequent year to the book value of Common Equity (*WC03501*) at the company's fiscal year end date. The expected Return on Equity ROE_{t+1}, in the denominator of the ratios, is defined as equal to the 12-month Forward Earnings Per Share (*EPS1FD12*) divided by the Common Equity (*WC03501*) at the fiscal year end date. The Common Equity is scaled by the Number of Common Shares Outstanding (*WC05301*).

Regarding the cost of equity estimation, we follow Gleason et al. (2013) approach and use Fama and French (1997) industry-specific risk premiums plus the risk-free rate. Following this rationale, we use the 10-Year Treasury bond yield (*USYIETBNR*) on 1 April of the subsequent year as the risk-free rate and the full-period CAPM-based (r_{CAPM} in *REP_1* and *REP_3*) and the Three-Factor-model-based (r_{tf} in *REP_2* and *REP_4*) industry-specific risk premiums for 48 industries. We use four-digit SIC codes to assign firms to the Fama and French (1997) industry categories. Moreover, we include in our analysis a constant cost of equity $r_e = 9\%$ in *REP_5* and *REP_6* to control for the effect of varying cost of equity estimates on the valuation outcome of *REP*. We follow McKinsey et al. (2020) and employ the midpoint in the range of their estimates of expected market return (8.7% to 9.3%). Regarding the growth factor, we assume either a zero-growth rate (for *REP_1*, *REP_2* and *REP_5*) or a perpetual growth rate equal to the long-term average US GDP real growth rate (*USWD3QBGR*) from 1961 to 2021 of 2.936% (for *REP_3*, *REP_4* and *REP_6*).[7]

We expect that financial analysts will exhibit relatively more (less) optimism for the stocks that the six alterative *REP* measures flag as undervalued (overvalued) with a *REP* value below (above) one. We formally assess this relationship by testing for any significant mean differences in the *TP/P* distribution across the two different groups of undervalued and overvalued equities.

In this paper, we also reverse-engineer the growth-adjusted *REP* formula to estimate the market-implied and the target-price-implied growth rates. We use the following two equations to estimate the implied growth rates. Both equations are based on a rearranged growth-adjusted *REP* formula:

$$g_{sp} = \frac{[(MV \times r) - (bv \times ROE)]}{(MV - bv)} \tag{18}$$

$$g_{tp} = \frac{[(TP \times r) - (bvps \times ROE)]}{(TP - bvps)} \tag{19}$$

where g_{sp} is the implied growth rate by the current stock price; *MV* is the market value of equity (*MV*); *r* is the cost of equity estimated by using: i) either the CAPM or Three-Factor model industry-specific risk premiums of Fama and French (1997); ii) r_e = 9%. The *bv* is the book value of Common Equity (*WC03501*); *ROE* is the expected Return on Equity measured as equal to the 12-month Forward Earnings Per Share (*EPS1FD12*) divided by the Common Equity (*WC03501*) at the fiscal year end date, which is scaled by the Number of Common Shares Outstanding (*WC05301*); g_{tp} is the implied growth rate by the financial analysts' consensus target price forecast; *TP* is the I/B/E/S Target Price Mean (*PTMN*); and *bvps* is the book value per share, defined as equal to the Common Equity (*WC03501*) at the fiscal year end date scaled by the Number of Common Shares Outstanding (*WC05301*).

We expect that the implied growth rates by the price targets will be greater than the ones implied by the concurrent stock price levels, since financial analysts usually exhibit an optimism bias in setting their target prices (Bradshaw et al., 2012b). We also expect that these rates will be lower than the cost of equity estimates and close to the nominal US GDP growth rates, which take into account the impact of inflation.

Similarly, we reverse-engineer the zero-growth and the growth-adjusted *REP* to calculate the implied cost of equity:

$$r_1 = bvps \times \frac{ROE}{P} \tag{20}$$

$$r_2 = g + bvps \times \frac{(ROE - g)}{P} \tag{21}$$

$$r_3 = bvps \times \frac{ROE}{TP} \tag{22}$$

$$r_4 = g + bvps \times \frac{(ROE - g)}{TP} \tag{23}$$

Furthermore, in order to examine whether *REP* is able to explain the current market pricing of stocks and the financial analysts' target prices, we produce pseudo target prices based on the six alternative *REP* specifications.

$$Pseudo - TP_1 = bvps \times \frac{ROE}{r_{CAPM}} \tag{22}$$

$$Pseudo - TP_2 = bvps \times \frac{ROE}{r_{tf}} \tag{23}$$

$$Pseudo - TP_3 = bvps \times \frac{(ROE - g)}{(r_{CAPM} - g)} \tag{24}$$

$$Pseudo - TP_4 = bvps \times \frac{(ROE - g)}{(r_{tf} - g)} \tag{25}$$

$$Pseudo - TP_5 = bvps \times \frac{ROE}{r_e} \tag{26}$$

$$Pseudo - TP_6 = bvps \times \frac{(ROE - g)}{(r_e - g)} \tag{27}$$

$Pseudo - TP_1$, $Pseudo - TP_2$ and $Pseudo - TP_5$ are the pseudo target prices from the zero-growth *REP* formula, while $Pseudo - TP_3$ and $Pseudo - TP_4$ and $Pseudo - TP_6$ are the pseudo target prices from the growth-adjusted *REP* formula that uses a perpetual growth rate equal to the long-term average annual US GDP real growth rate from 1961 to 2021. The cost of equity capital is estimated by using: i) the CAPM-based industry-specific risk premiums ($Pseudo - TP_1$, $Pseudo - TP_3$) or the Three-Factor model industry-specific risk premiums ($Pseudo - TP_2$, $Pseudo - TP_4$) of Fama and French (1997), and ii) a constant cost of equity $r_e =$ 9% ($Pseudo - TP_5$, $Pseudo - TP_6$).

In our analysis, we also employ a multivariate regression model that assesses the ability of *REP* to predict the one-year forward stock return.

$$\begin{aligned} R\mathrm{i,t+1} &= \alpha o + \alpha 1 dREP\mathrm{i,t} + \alpha 2SIZE\mathrm{i,t} + \alpha 3EV/EBITDA\mathrm{i,t} \\ &+ \alpha 4LEVERAGE\mathrm{i,t} + \alpha 5SALES\_GROWTH\mathrm{i,t} + \alpha 6WC\mathrm{i,t} + \alpha 7ROA\mathrm{i,t} + \varepsilon \mathrm{i} \end{aligned} \tag{28}$$

The dependent variable ***R***i, t + 1 expresses the one-year forward stock return and equals to the next year's percentage change of the Return Index (*RI*). ***dREP*** is a dummy variable that takes the value of one if the stock is considered overvalued according to REP (***REP***>1), and the value of zero when the stock is undervalued (0<***REP***<1). We also include in our regression analysis, the firm's ***SIZE***, ***EV/EBITDA***, *LEVERAGE*, ***SALES_GROWTH***, ***WC***, and ***ROA*** as control variables: a) ***SIZE*** is the natural logarithm of the firm's market capitalization (*MV*); b) ***EV/EBITDA*** is defined as the sum of the firm's market value (*MV*) and net debt (*WC18199*), divided by EBITDA (*WC18198*) at the fiscal year end date; c) ***LEVERAGE*** is defined as the firm's debt ratio – measured as equal

Table 3. Descriptive statistics of *REP* metrics**.**

Valuation Ratios	Number of Obs	Mean	Median	Standard Deviation
REP_1	11,509	1.96	1.232	2.879
REP_2	11,509	2.179	1.371	3.203
REP_3	10,805	1.635	0.951	2.67
REP_4	10,649	1.956	1.143	3.188
REP_5	11,509	2.227	1.433	3.19
REP_6	10,805	1.982	1.216	3.028

Note: The table provides the number of observations, and the mean, median and standard deviation of six alternative *REP* measures that we use in our empirical analysis: i) *REP_1* (zero growth, r_{CAPM}); ii) *REP_2* (zero growth, r_{tf}); iii) *REP_3* (g = long-term US GDP real growth rate, r_{CAPM}); iv) *REP_4* (g = long-term US GDP real growth rate, r_{tf}) v) *REP_5* (zero growth, $r_e = 9\%$); vi) *REP_6* (g = long-term US GDP real growth rate, $r_e = 9\%$). Variable definitions are provided in Table 2.

to the total debt (*WC03255*) scaled by the total assets (*WC02999*) at the fiscal year end date; d) ***SALES_GROWTH*** is defined as the percentage change of total sales over the previous year (*WC01001*); e) ***WC*** is the working capital (*WC03151*) scaled by total assets (*WC02999*) at the fiscal year end date; and f) ***ROA*** is defined as Net Income Before Extraordinary Items/Preferred Dividends (*WC01551*) scaled by Total Assets (*WC02999*) at the fiscal year end date. We offer six model specifications based on the different ***REP*** metrics.

5.2 Empirical results

Table 3 provides some descriptive statistics regarding the six specifications of *REP*. More particularly, it presents the mean, median and standard deviation of the six variations of *REP* stock screening methods. As said in the previous section, *REP_1*, *REP_2* and *REP_5* are based on the standard *REP* formula assuming a zero-growth rate, while *REP_3*, *REP_4* and *REP_6* are growth-adjusted metrics with a perpetual growth rate equal to the long-term average US GDP real growth rate of 2.936%. We estimate the cost of equity in *REP_1* and *REP_3* by using industry-specific estimates of CAPM-based market risk premiums, while *REP_2* and *REP_4* use industry-specific estimates of the Three-Factor model risk premiums (all industry estimates are based on Fama and French, 1997). In *REP_5* and *REP_6*, the cost of equity is constant and equals 9%. *REP_1*, *REP_2* and *REP_5* that ignore future growth opportunities, have median values of 1.232, 1.371 and 1.433, respectively. This finding implies that US equities are on average significantly overvalued based on the above investment appraisal techniques. On the other hand, *REP_3*, *REP_4* and *REP_6*, have median values closer to the benchmark value of one, implying that the use of a growth rate of approx. 3% is needed to justify the market levels during the period 2010–2021.

Table 4 provides further descriptive statistics on the components of *REP*, i.e., *P/B*, *ROE* and cost of equity across the sample period of 2010–2021. The median value of *P/B* for the whole period

Table 4. Descriptive statistics of *REP* components.

Panel A. Accounting and Financial Components	**Full Sample (Median)**
Price to Book Value (*P/B*) Multiple	2.01
Return on Equity (*ROE*)	13%
a. Cost of Equity from CAPM (r_{CAPM})	7.9%
b. Cost of Equity from Three-Factor-Model (r_{tf})	8.7%
Panel B. Implied Growth Rates	
Market-Implied Growth Rates:	
a. r_{CAPM}	3.3%
b. r_{tf}	4.6%
c. r = 9%	5.1%
Target-Price-Implied Growth Rates:	
a. r_{CAPM}	3.8%
b. r_{tf}	5.1%
c. $r = 9\%$	5.7%
Panel C. Implied Cost of Equity	
Market-Implied Cost of Equity:	
a. $g = 0$	6.2%
b. $g = 2.936\%$	7.7%
Target-Price-Implied Cost of Equity:	
a. $g = 0$	5.5%
b. $g = 2.936\%$	7.3%

Note: Panel A reports median values for the following four financial ratios across all years of our sample: i) Price-to-Book (*P/B*) multiple; ii) Return-on-Equity (*ROE*); iii) Cost of Equity (r_{CAPM}) calculated as the risk-free rate plus the CAPM-based industry-specific risk premium from Fama and French (1997); and iv) Cost of Equity (r_{tf}), calculated as the risk-free rate plus the Three-Factor-model-based industry-specific risk premium from Fama and French (1997). Panel B provides the median values of the market and target price implied growth rates by reverse-engineering the Rating to Economic Profit (*REP*) ratio. We use two Cost of Equity (r_{CAPM}, r_{tf}) estimates based on Fama and French (1997) and one fixed cost of equity $r_e = 9\%$. Similarly, Panel C reports the median values of the market and target price implied cost of equity estimates from the alternative versions of the *REP* formula that either ignore or incorporate future growth opportunities. Variable definitions are provided in Table 2.

stands at 2.01. Based on Penman (2013), the long-term median of this price multiple over the period 1963–2003 was 1.7. Lundholm and Sloan (2017) report a median *P/B* of 1.6 across the period 1962–2016. Our study's sample focuses on a period of significant stock market growth (i.e., a long bull market that follows the financial crisis of 2007–2009), so it is expected that the *P/B* will reflect the inflated stock market valuations and stand at higher levels compared to historical benchmarks.

Panel A of Table 4 also shows that median *ROE* is 13%. This estimate is close to long-term median *ROE* of 13.7% for large US-listed firms with market capitalization above $200 million across the period 1963–2010 (Penman, 2013). Furthermore, the median values the two cost of equity estimates are 7.9% (industry-specific CAPM-based risk premiums) and 8.7% (industry-specific Three-Factor-model-based risk premiums). In the low interest rate environment of our sample period, McKinsey et al. (2020) suggest using a cost of equity between 8.7 and 9.3%, so our study's estimates are close to this benchmark. Looking at the positive return spread of 4.3–5.1% between *ROE* and cost of equity, we can argue that the US-listed firms have created substantial value for their shareholders during our sample period.

Panel B of Table 4 provides information regarding the implied growth rates by reverse-engineering the growth-adjusted *REP* formula and using the current stock prices and financial analysts' consensus target price estimates. Based on our three cost of equity measures, we come up with reasonable market-implied growth rates of 3.3, 4.6 and 5.1%. These estimates are close to the long-term nominal growth rates of the US economy assuming a 3% real GDP growth rate and a 2% inflation rate (Lundholm & Sloan, 2017; and McKinsey et al., 2020). The target-price-implied growth rates stand at reasonably higher levels of 3.8, 5.1 and 5.7%. This finding is anticipated, since financial analysts typically exhibit optimism in setting their price targets for the firms they cover (Bradshaw et al., 2012b). Note that all implied growth estimates stand below the median cost of equity of our sample firms.

Panel C of Table 4 provides information regarding the median implied cost of equity estimates by reverse engineering the zero growth and growth-adjusted *REP* formulas. We first estimate the median market-implied cost of equity that is equal to 6.2% if we assume zero growth, or 7.7% if we apply a constant growth rate of 2.936%. We subsequently estimate the median target-price-implied cost of equity that stands at 5.5% with zero growth, and 7.3% with the use of a constant growth rate of 2.936%. Lower implied cost of equity values in the second case can be attributed to the analysts' optimistic target price forecasts that require lower cost of equity estimates in order to be justified.

Table 5 reports the results of our empirical analysis. First, we formally assess whether *REP* can explain the financial analysts' target price boldness. In other words, we examine if financial analysts issue relatively more (less) optimistic target prices for stocks regarded as undervalued (overvalued) based on the six adopted *REP* metrics. *REP_1*, *REP_2* and *REP_5* flagged 35, 27 and 22% of the total sample observations, respectively, as undervalued. By incorporating a growth factor in the *REP* formula, *REP_3*, *REP_4* and *REP 6* highlight a greater proportion of the total firm-year observations as undervalued, i.e., 53, 40 and 34%, respectively.

Regarding the empirical assessment of the mean differences in our target price boldness measure, we first look at the three standard *REP* metrics that ignore future growth opportunities.[8] Based on *REP_1*, financial analysts predict an average target-price-implied 12-month stock price increase of 37% (13%) for undervalued (overvalued) stocks with a *REP* value below (above) the benchmark value of one. This difference is statistically significant at the 1% level (*t-test* = 24.56, *p-value* < 0.01). Similarly, based on *REP_2*, financial analysts predict an average target-price-implied 12-month stock price increase of 43% (13%) for undervalued (overvalued) stocks with a *REP* value below (above) the benchmark value of one. This difference is again statistically significant at the 1% level (*t-test* = 28.07, *p-value* < 0.01). Also, based on *REP_5*, financial analysts predict an average target-price-implied 12-month stock price increase of 49% (14%) for undervalued (overvalued) stocks with a *REP* value below (above) the benchmark value of one. This difference is again statistically significant at the 1% level (*t-test* = 31.14, *p-value* < 0.01).

Table 5. Formal empirical assessment of mean differences in ***TP/P*** and ***Ri***.

Panel A. *REP*_1 (zero growth, r_{CAPM})

Group	Num. of Obs	*REP* Mean	*TP /P* Mean	*Ri* Mean	*TP/P*: Differences between two groups t-statistic	p-value	*RI*: Differences between two groups t-statistic	p-value
0 < *REP*_1< 1	3,949	0.70	1.37	0.22				
*REP*_1 > 1	7,419	2.62	1.13	0.14	24.56	0.000	6.1	0.000

Panel B. *REP*_2 (zero growth, r_{tf})

Group	Num. of Obs	*REP* Mean	*TP /P* Mean	*Ri* Mean	*TP/P*: Differences between two groups t-statistic	p-value	*RI*: Differences between two groups t-statistic	p-value
0< *REP*_2< 1	3,125	0.68	1.43	0.22				
*REP*_2 > 1	8,243	2.73	1.13	0.14	28.07	0.000	5.64	0.000

Panel C. *REP*_3 (*g* = long-term US GDP real growth rate, r_{CAPM})

Group	Num. of Obs	*REP* Mean	*TP /P* Mean	*Ri* Mean	*TP/P*: Differences between two groups t-statistic	p-value	*RI*: Differences between two groups t-statistic	p-value
0< *REP*_3< 1	5,706	0.63	1.28	0.19				
*REP*_3 > 1	4,984	2.78	1.13	0.13	16.45	0.0000	5.51	0.000

Panel D. *REP*_4 (*g* = long-term US GDP real growth rate, r_{tf})

Group	Num. of Obs	*REP* Mean	*TP /P* Mean	*Ri* Mean	*TP/P*: Differences between two groups t-statistic	p-value	*RI*: Differences between two groups t-statistic	p-value
0< *REP*_4< 1	4,267	0.65	1.33	0.20				
*REP*_4 > 1	6,269	2.84	1.13	0.13	21.72	0.000	5.6	0.000

Panel E. *REP*_5 (*g* = zero growth, $r_e = 9\%$)

Group	Num. of Obs	*REP* Mean	*TP /P* Mean	*Ri* Mean	*TP/P*: Differences between two groups t-statistic	p-value	*RI*: Differences between two groups t-statistic	p-value
0< *REP*_5< 1	2,548	0.72	1.49	0.24				
*REP*_5 > 1	8,820	2.65	1.14	0.14	31.14	0.000	6.85	0.000

Panel F. *REP*_6 (*g* = long-term US GDP real growth rate, $r_e = 9\%$)

Group	Num. of Obs	*REP* Mean	*TP /P* Mean	*Ri* Mean	*TP/P*: Differences between two groups t-statistic	p-value	*RI*: Differences between two groups t-statistic	p-value
0< *REP*_6< 1	3,674	0.70	1.36	0.21				
*REP*_6 > 1	7,016	2.65	1.13	0.14	24.70	0.000	6.18	0.000

Note: The table reports the mean values of target price boldness (*TP/P*) and one-year forward stock return (*Ri*) for each *REP* group of undervalued and overvalued stocks. In each Panel, the sample of firm-year observations is divided in two groups based on whether *REP* takes values between zero and one (undervalued stocks), or higher than one (overvalued stocks). To increase the robustness of our work, we employ six different Rating to Economic Profit (*REP*) metrics: *REP*_1 (zero growth, r_{CAPM}); ii) *REP*_2 (zero growth, r_{tf}); iii) *REP*_3 (*g* = long-term US GDP real growth rate, r_{CAPM}); iv) *REP_4* (*g* = long-term US GDP real growth rate, r_{tf}); v) *REP*_5 (zero growth, $r_e = 9\%$); and, vi) *REP_6* (*g* = long-term US GDP real growth rate, $r_e = 9\%$).The mean difference tests in *TP/P* and *Ri* are performed by using t-test. Variable definitions are provided in Table 2.

Subsequently, we look at the three growth-adjusted *REP* metrics that include a growth factor equal to 2.936%. Based on *REP_3*, financial analysts predict a mean stock price increase of 28% (13%) for undervalued (overvalued) stocks based on the *REP* formula. This difference is statistically significant at the 1% level (*t-test* = 16.45, *p-value* < 0.01). Based on *REP_4*, financial analysts predict a mean stock price increase of 33% (13%) for undervalued (overvalued) stocks based on the particular *REP* metric. This difference is again statistically significant at the 1% level (*t-test* = 21.72, *p-value* < 0.01). Finally, based on *REP_6*, financial analysts predict a mean stock price increase of 36% (13%)

Table 6. One-year forward stock returns of ***REP*** quintile portfolios.

Ri on REP **Portfolios:**	***Ri*** **(Q1)** Mean	***Ri*****(Q2)** Mean	***Ri*****(Q3)** Mean	***Ri*****(Q4)** Mean	***Ri*****(Q5)** Mean	**Upper – Lower:** t-statistic	p-value
REP_1	21.6%	15.3%	13.2%	10.9%	11.9%	6.00	0.000
REP_2	19.8%	17.6%	12.2%	11.6%	11.7%	6.00	0.000
REP_3	19.0%	18.0%	13.7%	10.2%	12.2%	4.19	0.000
REP_4	18.4%	17.8%	14.6%	10.7%	11.4%	4.35	0.000
REP_5	21.4%	15.2%	12.3%	11.2%	12.9%	5.11	0.000
REP_6	20.3%	15.9%	12.8%	11.8%	12.2%	4.77	0.000

Note: The Table reports the mean values of one-year forward stock returns *Ri* for each *REP* quantile portfolios (*REP* $>$ 0). To increase the robustness of our work, we employ the six different Rating to Economic Profit (*REP*) metrics: *REP*_1 (zero growth, r_{CAPM}); ii) *REP*_2 (zero growth, r_{tf}); iii) *REP*_3 (g = long-term US GDP real growth rate, r_{CAPM}); iv) *REP_4* (g = long-term US GDP real growth rate, r_{tf}); v) *REP*_5 (zero growth, $r_e = 9\%$); and, vi) *REP_6* (g = long-term US GDP real growth rate, $r_e = 9\%$). A t-test is conducted for the differences between the upper and the lower quantiles. Variable definitions are provided in Table 2.

for undervalued (overvalued) stocks based on the particular *REP* metric. This difference is again statistically significant at the 1% level (*t-test* = 24.70, *p-value* < 0.01).

We employ six *REP* measures to increase the robustness of our study. In all the empirical settings, mean differences in the adopted target price to current stock price boldness measure are statistically significant. It seems that *REP*, a sophisticated yet simple in its practical implementation valuation ratio, can explain in reasonable ways the differences in financial analysts' target price optimism. We believe that the above findings constitute a significant addition to the relevant literature and complement previous studies on target prices (Bradshaw, 2002; Gleason et al., 2013).

Furthermore, we formally assess whether *REP* can predict the one-year forward stock return. The results indicate that the average one-year forward stock returns on undervalued stocks are higher than the average one-year forward stock returns on overvalued stocks according to all six *REP* metrics.

Table 6 complements the previous findings by examining the one-year forward stock returns of *REP*-based quintile portfolios. We conduct a T-test to test mean differences between the upper and lower quintiles. In all of our *REP* specifications, the results are very interesting and indicate that the one-year forward stock return decreases as the *REP* estimate increases. The results are according to our expectations and confirm the usefulness of the *REP* as an investment criterion. For example, based on the zero growth *REP_1,* the mean one-year forward stock returns of the 1st and 5th quintiles are 21.6% and 11.9%, respectively (*t-test* = 6.00, *p-value* < 0.01). Based on the growth-adjusted *REP_3,* the mean one-year forward stock returns of the 1st and 5th quintiles are 19% and 12.2%, respectively (*t-test* = 4.19, *p-value* < 0.01). The findings are similar to the other four zero-growth (*REP_2*, *REP_5*) and growth-adjusted *REP* metrics (*REP_4*, *REP_6*).

Table 7 provides the results of our *OLS* regression models that examine the ability of *REP*-based pseudo target prices to explain the contemporaneous market valuations of our sample firms. The *OLS* regression analysis is conducted with firm and year fixed effects and a clustering of standard errors by firm to control for autocorrelation and heteroscedasticity. We use the I/B/E/S Price (*P*) as dependent variable and six different pseudo target prices based on alternative specifications of *REP* ($Pseudo - TP_1$, $Pseudo - TP_2$, $Pseudo - TP_3$, $Pseudo - TP_4$, $Pseudo - TP_5$,, $Pseudo - TP_6$) as single independent variables in each different regression model. All the coefficients on our single independent variables in each regression model have positive signs and are statistically significant. All six models have strong explanatory power ($R^2 > 0.87$). More specifically, the coefficients on $Pseudo - TP_1$, $Pseudo - TP_2$, $Pseudo - TP_5$ (that assume zero growth) have values very close to one (0.930, 0.810 and 1.185 respectively) that are statistically significant at the 1% level (*p-value* < 0.01). The results are similar when a growth factor of 2.936% is added in the *REP* formula. $Pseudo - TP_3$, $Pseudo - TP_4$ and $Pseudo - TP_6$ have coefficients of 0.543, 0.477 and 0.858 respectively, which are again statistically significant at the 1% level (*p-value* < 0.01).

Table 7. The explanation of concurrent stock market valuations by pseudo-target prices based on ***REP***.

	***P*(*M*1)**		***P*(*M*2)**		***P*(*M*3)**		***P*(*M*4)**		***P*(*M*5)**		***P*(*M*6)**	
Independent variable	Coefficient	p-value	Coefficient	p-value	coefficient	p-value	coefficient	p-value	coefficient	p-value	coefficient	p-value
***Pseudo* − *TP*1**	0.930***	0.000										
***Pseudo* − *TP*2**			0.810***	0.000								
***Pseudo* − *TP*3**					0.543***	0.000						
***Pseudo* − *TP*4**							0.477***	0.000				
***Pseudo* − *TP*5**									1.185***	0.000		
***Pseudo* − *TP*6**											0.858***	
Intercept	13.39***	0.000	19.3***	0.000	21.83***	0.000	27.72***	0.000	10.59***	0.000	16.24***	0.000
Number of Obs.	11,085		11,085		10,494		10,330		11,085		10,494	
R-squared	0.895		0.888		0.874		0.871		0.903		0.892	

Note: The table reports the results of our *OLS* regression analysis with firm/year fixed effects, that assesses the ability of the *REP* ratio to explain the contemporaneous stock market valuations of our sample firms. The Table presents six model specifications with dependent variables the I/B/E/S Price (*P*) and a single independent variable in each model, i.e., a pseudo target price produced by a specific *REP* ratio. More specifically, $Pseudo\text{-}TP_1$ is the pseudo target price derived from the *REP* ratio that ignores future growth opportunities and uses r_{CAPM} as cost of equity; $Pseudo\text{-}TP_2$ is the pseudo target price derived from the *REP* ratio that ignores future growth opportunities and uses r_{tf} as cost of equity; $Pseudo\text{-}TP_3$ is the pseudo target price derived from the growth-adjusted *REP* ratio that uses r_{CAPM} as cost of equity; $Pseudo\text{-}TP_4$ is the pseudo target price derived from the growth-adjusted *REP* ratio that uses r_{tf} as cost of equity; $Pseudo\text{-}TP_5$ is the pseudo target price from the *REP* ratio that ignores future growth opportunities and employs $r_e = 9\%$ as the cost of equity; and $Pseudo\text{-}TP_6$ is the pseudo target price from the *REP* ratio that assumes a constant future growth rate and uses the cost of equity $r_e = 9\%$. Variable definitions and datatypes are provided in Table 2. ***Statistically significant values at 1%. **Statistically significant at 5%. *Statistically significant at 10%.

Table 8. The justification of financial analysts' target prices by pseudo-target prices based on ***REP***.

	TP(***M***1)		***TP***(***M***2)		***TP***(***M***3)		***TP***(***M***4)		***TP***(***M***5)		***TP***(***M***6)	
Independent variable	coefficient	p-value	Coefficient	p-value	coefficient	p-value	coefficient	p-value	coefficient	p-value	coefficient	p-value
***Pseudo* − *TP*1**	1.105***	0.000										
***Pseudo* − *TP*2**			0.957***	0.000								
***Pseudo* − *TP*3**					0.646***	0.000						
***Pseudo* − *TP*4**							0.567***	0.000				
***Pseudo* − *TP*5**									1.385***	0.000		
***Pseudo* − *TP*6**											1.001***	0.000
Intercept	12.20***	0.000	19.41***	0.000	22.07***	0.000	29.05***	0.000	9.717***	0.000	16.29***	0.000
Number of Obs.	10,947		10,947		10,379		10,216		10,947		10,379	
R-squared	0.897		0.886		0.874		0.869		0.904		0.891	

Note: The table reports the results of our *OLS* regression analysis with firm/year fixed effects that assesses the ability of the *REP* ratio to justify the financial analysts' consensus target prices for our sample firms. The Table presents six model specifications with dependent variable the I/B/E/S Target Price Mean (*TP*) and a single independent variable in each model, i.e., a pseudo target price produced by a specific *REP* ratio. More specifically, $Pseudo\text{-}TP_1$ is the pseudo target price derived from the *REP* ratio that ignores future growth opportunities and uses r_{CAPM} as cost of equity; $Pseudo\text{-}TP_2$ is the pseudo target price derived from the *REP* ratio that ignores future growth opportunities and uses r_{tf} as cost of equity; $Pseudo\text{-}TP_3$ is the pseudo target price derived from the growth-adjusted *REP* ratio that uses r_{CAPM} as cost of equity; and $Pseudo\text{-}TP_4$ is the pseudo target price derived from the growth-adjusted *REP* ratio that uses r_{tf} as cost of equity; $Pseudo\text{-}TP_5$ is the pseudo target price from the REP ratio that ignores future growth opportunities and employs re = 9% as the cost of equity; and $Pseudo\text{-}TP_6$ is the pseudo target price from the REP ratio that assumes a constant future growth rate and uses the cost of equity re = 9%. Variable definitions and datatypes are provided in Table II. ***Statistically significant values at 1%. **Statistically significant at 5%. *Statistically significant at 10%.

Table 9. The prediction of 1-year forward stock returns by the ***REP***.

Independent variable	***Ri*** (M1)	p-value	***Ri*** (M2)	p-value	***Ri*** (M3)	p-value	***Ri*** (M4)	p-value	***Ri*** (M5)	p-value	***Ri*** (M6)	p-value
***dREP*_1**	−0.057***	0.000										
***dREP*_2**			−0.054***	0.003								
***dREP*_3**					−0.031**	0.035						
***dREP*_4**							−0.027*	0.069				
***dREP*_5**									−0.062***	0.001		
***dREP*_6**											−0.045***	0.003
SIZE	−0.183***	0.000	−0.184***	0.000	−0.203***	0.000	−0.201***	0.000	−0.184***	0.000	−0.203***	0.000
EV/EBITDA	−0.001**	0.025	−0.001**	0.024	−0.001**	0.012	−0.001**	0.018	−0.001**	0.027	−0.001**	0.0152
LEVERAGE	−0.003	0.547	−0.003	0.576	−0.001	0.833	0.000	0.940	−0.003	0.558	−0.001	−0.797
SALES_GROWTH	−0.055**	0.012	−0.055**	0.013	−0.053**	0.017	−0.054**	0.017	−0.055**	0.013	−0.053**	0.018
WC	0.049	0.588	0.045	0.618	0.047	0.610	0.033	0.729	0.044	0.627	0.050	0.583
ROA	−0.006***	0.000	−0.006***	0.000	−0.006***	0.000	−0.006***	0.000	−0.006***	0.000	−0.006***	0.000
Observations	7,317		7,317		7,114		6,955		7,317		7,114	
R-squared	0.513		0.513		0.511		0.515		0.513		0.511	

Note: The table reports the results of *OLS* regression analysis with firm/year fixed effects, that assesses the ability of the *REP* to predict the one-year forward stock returns. We include the firm's *SIZE, EV/EBITDA, LEVERAGE, SALES_GROWTH, WC*, and *ROA* as control variables: a) *SIZE* is the natural logarithm of the firm's market capitalization (MV); b) *EV/EBITDA* is defined as the sum of the firm's market value (*MV*) and net debt (*WC18199*), divided by the EBITDA (*WC18198*) at the fiscal year end date; c) *LEVERAGE* is defined as is the firm's debt ratio, measured as equal to the total debt (*WC03255*) scaled by the total assets (*WC02999*) at the fiscal year end date; d) *SALES_GROWTH* is defined as the percentage change of total sales over the previous year (*WC01001*); e) *WC* is the working capital (*WC03151*) scaled by total assets (*WC02999*) at the fiscal year end date; and, f) *ROA* is defined as Net Income Before Extraordinary Items/Preferred Dividends (*WC01551*) scaled by Total Assets (*WC02999*) at the fiscal year end date. *dREP*_1, *dREP*_2, *dREP*_3, *dREP*_4, *dREP*_5 and *dREP*_6 are dummy variables that take the value of zero when 0<*REP*<1 and the value of 1 when *REP*>1.

In a similar fashion, Table 8 reports the results of our *OLS* regression models that examine the ability of *REP*-based target prices to explain financial analysts' actual target prices and thereby assesses whether *REP* can be used as an investment tool by financial analysts. We use the I/B/E/S Mean Target Price (*PTMN*) as the dependent variable and again the six different pseudo target prices based on alternative specifications of *REP* ($Pseudo - TP_1$, $Pseudo - TP_2$, $Pseudo - TP_3$, $Pseudo - TP_4$,, $Pseudo - TP_5$, $Pseudo - TP_6$) as single independent variables in each different regression model. The results here verify our main argument that *REP* can be successfully used not only as an investment screening method, but also as a model to derive financial analysts' target prices. All six regression models exhibit again high explanatory power ($R^2 > 0.86$). The pseudo target price coefficients have again positive signs and are all statistically significant at the 1% level (*p-value* < 0.01). The results are similar with Table 7. More specifically, $Pseudo - TP_1$, $Pseudo - TP_2$ and $Pseudo - TP_5$ have coefficient values of 1.105, 0.957 and 1.385 respectively, while $Pseudo - TP_3$, $Pseudo - TP_4$ and $Pseudo - TP_6$ have coefficient values of 0.646, 0.567 and 1.001 respectively. To sum up, the results of our regression models in Tables 7 and 8, strongly indicate that the *REP* ratio can both explain the contemporaneous stock market valuations and be used as a model to derive financial analysts' target prices.

Table 9 illustrates the results of *OLS* regression analysis that assesses the ability of the *REP* to predict the one-year forward stock returns after controlling for a number of standard fundamentals-based financial ratios. The *OLS* regression analysis includes firm and year fixed effects and clustering standard errors by firm to control for autocorrelation and heteroscedasticity (Petersen, 2009). We offer six model specifications based on our six *REP* metrics. The results justify once again our hypothesis that ***REP*** can be successfully used as an investment screening method. As expected, the coefficients on ***dREP***_1, ***dREP***_2, ***dREP***_3, ***dREP***_4, ***dREP***_5, ***dREP***_6 are negative and statistically significant, and the models have a good explanatory power $R^2 > 0.5$). ***dREP***_1, ***dREP***_2, ***dREP***_5 and ***dREP***_6 are statistically significant at 1% level, ***dREP***_3 is statistically significant at 5% level, and ***dREP***_4 is statistically significant at 10% level. These findings illustrate that the use of the ***REP*** ratio as an investment criterion, which employs the benchmark value of one to classify stocks as overvalued or undervalued, could predict stock returns during the following 12-month horizon.

6. Summary and conclusions

The primary objectives of this study are to provide a comprehensive analysis of the valuation properties and practical implementation issues of the Rating to Economic Profit (*REP*), as well as an empirical assessment of its use by financial analysts to set the price targets for their stock coverage universe. While employed by financial analysts in capital markets, *REP* is not yet adopted by standard financial statement analysis textbooks. These texts normally discuss the determinants of *P/B*, but they do not present *REP* as an available stock screening method for the fundamental analyst and investor. *REP* generates a stock recommendation based on a comparison of the current market rating of the firm's stock with its fundamentals. Specifically, the equity version of *REP* compares the *P/B* multiple to the ratio of the firm's expected *ROE* to cost of equity capital. As is the case with the well-known *PEG* ratio, a stock price recommendation is generated conditional on whether *REP* is greater than one (Sell), equal to one (Hold) or less than one (Buy).

We show how this investment appraisal technique stems from the residual income valuation (*RIV*) model and consider some practical implementation issues, such as the effects of accounting conservatism, the occurrence of losses and/or extraordinary (non-recurring) items, the implications of capital structure choices, and the existence of significant growth opportunities. Especially with respect to expected growth, the *REP* formula is modified by incorporating a growth factor, based on the Gordon Growth Model (*GGM*). It is noteworthy that many financial analysts when referring to *GGM*, they actually employ a variation of the *REP* formula to calculate a fair *P/B*, which they subsequently use to derive their target price. This descriptive evidence from analysts' equity research reports provides further support for arguments that favour the use of accrual accounting numbers over dividends for value measurement purposes.

We also provide descriptive evidence of the proportions of US-listed firms that are considered overvalued or undervalued by applying *REP*, and offer estimates of the implied growth rates and implied cost of equity by reverse-engineering the various alternative formulas of *REP*. Furthermore, we conduct a formal empirical assessment of the relationship between *REP* and a target price boldness measure and the relationship between *REP* and the one-year forward stock return. We show that financial analysts actually issue relatively more (less) optimistic target prices for the undervalued (overvalued) stocks with a *REP* value below (above) one. We further show that the one-year forward stock return is higher (lower) for the undervalued (overvalued) stocks according to the *REP* metric. Finally, we employ *OLS* regression models to demonstrate that: i) *REP* explains the contemporaneous stock market valuations of our sample firms; ii) *REP* can be used as a useful investment tool by financial analysts to derive their target price forecasts, and ii) *REP* can predict the one-year forward stock returns after controlling for a number of standard fundamentals-based financial ratios.

This paper shows how financial analysts combine the *P/B* ratio with *ROE* in order to evaluate the investment attractiveness of firms. We believe that the discussion of this relationship between *P/B* and *ROE*, along with the illustrative examples from equity research reports, will be of interest to valuation educators, who would like to enrich their fundamental analysis courses with applied valuation cases, as well as investment professionals, who may consider useful and interesting a critical perspective on a practical valuation model.

In terms of further research opportunities, it would be interesting for other researchers to analyse the content of equity research reports in order to identify other hybrid models and sector-specific valuation techniques that analysts may employ. In dividend discount and discounted cash flow models, terminal values represent a substantial proportion of the estimated fundamental value. In this paper, we provide some descriptive evidence that in certain circumstances financial analysts might choose accrual accounting numbers to estimate the terminal values of dividend discount models. Hence, it would be interesting to investigate how financial analysts actually measure this crucial input to multi-period valuation methodologies (Nissim, 2019).

Finally, given the fact that *REP*, a fundamentals-based investment appraisal technique, and *PEG*, a heuristic multiple, have the same benchmark value of one, another promising area for future research may be the comparative assessment of the profitability of investment strategies, based on these two stock-screening methods.

Notes

1. The current study extends the model, which is first presented by Demirakos et al. (2004), by providing a comprehensive analysis of the Rating to Economic Profit, practical examples of its actual implementation, and an empirical assessment of its ability to justify financial analysts' target prices, explain contemporaneous stock market valuations, and predict future stock returns.
2. For a historical perspective on the notion of economic income, see Hicks (1946).
3. This is also the standard formula that HSBC's equity research analysts actually use.
4. In the discussion of this subsection, we assume that the firm has reached a steady state and therefore the growth rates of its dividends, earnings, book values and residual income converge. Similarly, the growth-adjusted version of the *REP* formula can be derived from the *RIV* model.
5. We apply this criterion in order to examine firms with a fiscal year end date close to the calendar year end date.
6. We thank a Refinitiv representative for suggesting these datatypes for the purposes of our research project.
7. In a recent study, Alle et al. (2020) find that valuation specialists typically use the GDP growth rate as a proxy for the firm's long-term growth rate in their valuation exercises.
8. There are some minor differences between the total number of firm-year observations for each *REP* metric between Table 1 and Table 5 due to the removal of observations with non-available *TP/P* data in Table 5.

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Data availability

All data are publicly available from data sources identified in the text.

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