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Observed and "fundamental" price earning ratios: a comparative analysis of high-tech stock evaluation in the US and Europe[1]

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Abstract

By assuming that a large share of investors (which we call fundamentalists) follows a fundamental approach to stock picking, we build a discounted cash flow (DCF) model and test on a sample of high-tech stocks whether the strong and the weak version of the model are supported by data from the US and European stock markets. Empirical results show that "fundamental" earning price ratios explain a significant share of cross sectional variation of the observed E/P ratios, with other additional variables being only partially and weakly relevant. Within this general framework, valid both for Europe and the US, empirical results outline significant differences between the two markets. The most relevant of them is that the relationship between observed and fundamental E/P ratios is much weaker in Europe.

JEL Codes: G12, G14

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1. Introduction

With the ICT revolution of the last decades creation of value (especially in the high-tech industry) is becoming more and more related to intangible assets and competition increasingly related to non-price factors. According to results from a recent EU research project, by 1988 only 15 percent of S&P500 value was attributed to tangible assets, compared to 62 percent in 1982 (Eustace, 2002).[2] These changes are likely to be part of the response to observed anomalies such as the sharp uptrend in the price to book ratio which has risen three times between 1981 and 1996 for the Dow Jones Industrial Average (Lee, Myers and Swaminathan, 1999). In this new framework, the problem of evaluating and incorporating the value of intangibles in estimates of stock fundamentals, generally based on balance sheet measures, is becoming always more important. The challenge is to use forward looking models with limited reference to those balance sheet measures incapable of incorporating the effects of intangibles on corporate values. The present paper follows this direction. On the one hand, we investigate whether analysts, in their forward looking expectations, are capable of incorporating these changes into their forecasted fundamentals. On the other hand, we want to know whether market prices are consistent with these evaluations. We do this through a comparison between US and EU stocks to see whether differences in regulatory environments and in the composition of financial market investors between the US and EU systems affects the capacity to tackle the challenge of the "evaluation puzzle" described above. Even though clear cut distinctions among "archetypal market structures" exist only in theory, we may find in the US financial markets (compared to EU markets) relatively stricter rules for information disclosure[3] and

[2] The EU's High Level Expert Group on the Intangible Economy comments this issue arguing that "the various interest groups are struggling to adapt their analytical models, standards and regulatory policies to reflect the economics of intangibles. The overriding problem is how to isolate the new performance drivers – the portfolio of assets, quasi-assets, commodities and competencies we need to measure" (Eustace, 2002).

[3] The International Accounting Standards Committee (IASC) has set an International Accounting Standard. Each year National Accounting Standards are benchmarked against IAS in his annual report. The 2001 annual report clearly shows that Accounting Standards of all stocks from European countries included in our sample do not follow IAS standards in the disclosure of earnings per share and many other crucial balance sheet items, differently from US Accounting Standards.

higher severity in the repression of the insider trading[4] together with a more pervasive presence of institutional investors (Allen-Gale, 1992, 2000). The role of institutional investors is usually expected to increase the share of long term investors looking at fundamentals.

The industry in which the ICT revolution went further is the high-tech industry where the impact of intangibles on asset values is expected to be higher[5] and where anomalies such that zero dividend payment are relatively more frequent.[6] Moreover, the low marketability of firms' assets in the high-tech sector implies that an evaluation of the firm based on the market value of its capital is far more complicated than in traditional sectors. This is why we believe that a sample of high-tech companies represents a very interesting benchmark for testing the correspondence between analysts forecasted and market observed values.

To evaluate stock market fundamentals we must also take into account that trades and prices are determined by a large number of investors with nonhomogeneous beliefs and information sets.

Most theoretical and empirical papers analysing the effects of financial markets microstructure on asset prices hinge on the interaction between a group of more informed (rational) and a group of less informed (noise, liquidity or near rational) traders (Grossman-Stiglitz, 1980; De Long et al.,1990; Allen-Taylor, 1990; Curcio-Goodhart, 1991).

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[4] Fund managers interviewed about the differences between US and European financial markets report that "A primary disadvantage is the lack of a centralized regulatory body (such as those in the US or UK). Similar to the US and in order to create more transparency, these regulatory bodies should implement insider-trading rules (e.g. filing of buy and sell activity of directors or major shareholders, filing of total positions held, etc.). When these rules are violated, there should be strict rules for punishment. Without this legal framework, the market will always be vulnerable to manipulation." (CSFB, 2002)

[5] More specifically, the value of high-tech stocks is highly likely to be affected by the definition and evolution of technological standards which are crucial in markets with large network externalities (Varian, 2000). Uncertainties on which firm would eventually reach a critical mass in new markets with network externalities make expectations on future cash flow highly volatile. The difficulties in evaluation due to the higher role played by intangibles for high-tech stocks may be offset by the fact that high tech firms tend to be followed by a larger number of analysts than firms in traditional sectors. This enhances the accuracy of forecasts and allows a better estimation of their variability across different analysts (Chung-Jo, 1996).

[6] In a world of imperfect information a firm's dividend policy may disclose some information on the permanent component of earnings. For this reason, investors and financial press argue that high tech stocks' prices are more sensitive than other stock prices to changes in the projected cash flows both from a time series and from a cross-sectional point of view. "*Since most tech stocks pay little or no dividends, investors are buying them almost entirely for their potential growth in revenue and profits. That means prices are ultrasensitive to changes in projections of long-term profit growth."* (BusinessWeek "Are High-Tech Stocks Headed for More Turmoil?" February 5, 2001).

Having this literature as a reference, the simple but quite general hypothesis adopted by our paper is that the first group of traders compute a "fundamental value" of the firm according to a generally established rule and buys (sells) stocks which are undervalued (overvalued) with respect to the estimated fundamental. The second group of traders has a different perspective and, roughly speaking, adopts trend-following strategies buying (selling) a rising (falling) stock even if it is above (below) its fundamental value.[7]

Within this framework, the paper develops a standard "two-stage growth" discounted cash flow (henceforth DCF) model which is expected to be commonly adopted by the so called "fundamentalists", and tests whether cross-sectional variability of price earning ratios[8] may be explained by the model or if additional variables need to be taken into account.[9]

In calculating the fundamental value of the stock, we use a set of explanatory variables that are likely to affect significantly price earning ratios. These are the IBES consensus forecast on 1-year, 2-year ahead and long term earnings growth. Our choice of considering these variables implies the cost of working with panels of reduced time dimension. This cost is traded-off with the advantage of exploiting information which is presumably evaluated by financial traders in their decision process.[10] This advantage reduces divergences in interpreting the fundamental value and increases the likelihood that our approach closely resembles the approach most widely followed by fundamentalists.

[7] For similar approaches explaining financial asset prices on the basis of the relative weight of fundamentalists and chartists see Goodhart (1988), Frankel-Froot (1990), Kirman (1991), Pilbeam (1995), Sethi (1996) and Franke-Sethi (1998).

[8] Researchers usually study the cross-sectional dispersion of returns rather than that of P/E ratios. In our case, though we are testing the behaviour of fundamentalists and, in particular, whether they incorporate expected future earnings in their forecasts. Furthermore, the focus on P/E ratios allows us to test directly the static no arbitrage condition (price equal net present value of a stock) whose validity is only implicitly assumed when working on stock returns. Our approach also aims to provide information on overevaluation or underevaluation of stocks which cannot be provided by an investigation on stock returns.

[9] One of the reasons for developing our analysis on price earnings is that this indicator parsimoniously uses available information for firms having positive earnings. It is in fact possible to evaluate the fundamental value of these stocks by knowing just the expected earnings rate of growth and not the current absolute value of earnings (see section 3).

[10] The advantage of working with IBES forecasts of long term earnings growth is evident. This variable represents a better proxy for the effective *ex ante* traders' expectations than, either VAR forecasts, or effectively realised ex post earning growth.

The paper is divided into six sections (including introduction and conclusions). The second section presents a short survey of the literature on the determinants of price earning ratios and illustrates the contribution of this paper. The third section focuses on a descriptive analysis on the comparative features of the US and European samples. The fourth section presents a standard DCF model. On the basis of this model two hypotheses are tested on a sample of US and European high-tech stocks: i) the strong relevance of the DCF model (only the DCF variable matters); ii) the weak relevance of the DCF model (factors correcting for forecasting accuracy also matter). Empirical results presented in the fifth section highlight interesting differences in the evaluation of European and US high-tech stocks and do not reject the hypothesis that stock values reflect the DCF value (much more in the US than in Europe) corrected (only in some limited time spells) for signals which reduce asymmetric information between firms and investors.

2. The determinants of P/E ratios: the state of art and our proposed contribution

The traditional DCF approach discounts dividends and not earnings. In recent times, though, many companies started to postpone dividend payments at later stages of their life cycle (Campbell, 2000). In parallel, several authors started using earnings more than dividends to predict stock returns (Campbell, 2000, Olhson, 1995; Ang-Liu, 1998; Vuolteenaho, 1999; Fama-French, 1998; Lamont, 1998)

If we follow this recent approach and assume that market agents have homogeneous rational expectations and the price of a stock reflects the value of current and future expected earnings corrected for a risk adjusted discount factor, the cross-sectional dispersion of price/earning ratios should reflect in first place differences in risk and differences between current and future expected earnings across stocks. For this reason the P/E has been originally considered as an indicator of transitory earnings (Molodovsky, 1953), future earnings (Cragg-Malkiel, 1982; Rao-Litzenberger,

1971) or risk (Ball, 1978). If, on the contrary, investors' information sets are not homogeneous, low P/E ratios may signal underevaluated stocks and portfolios of low P/E stocks should yield excess returns even after they are adjusted for risk (Basu, 1977; Jaffe, Keim and Westerfield, 1989).

Even assuming nonhomogeneous information sets, the hypothesis that all market agents evaluate the price of the stock according to a discounted cash flow approach is still a useful benchmark which can be tested and rejected in favor of alternative hypotheses. Its implications are that the expected growth of earnings and payout (risk and persistence) should be negatively (positively) related to the earning price ratio (Cho, 1994).

An empirical test of the DCF model is provided by Kim and Koveos (1994) with a panel cross-country analysis. The authors find support for the negative effect of risk and for the positive effect of growth and payout on price earnings. They also find that the right proxy for the first variable is the dispersion of analysts' estimates (and not firm beta) while the right proxy for the second is analysts' expected growth (and not historical growth).

Many empirical analyses on the determinants of P/E ratios outline the presence of a risk puzzle. In fact, Beaver and Morse (1978) do not find that risk or growth explain cross-sectional differences in P/E ratios and Zarrowin (1990) shows that cross-sectional differences in forecasted long term growth are the main determinants of variations in P/E ratios, while beta is not important.

The contribution of this paper to the above mentioned literature is that of directly testing the relevance of a DCF model commonly adopted by pratictioners. We in fact calculate theoretical price earning ratios by using one of the most widely followed DCF formulas and check if they explain cross-sectional differences in price earnings on a sample of high-tech stocks listed at US and European stock exchanges. The advantage in following this approach is that we test: i) the relevance of the adoption of a common fundamentalist rule and therefore the existence of this group of traders; ii) the role of previously unexplored variables which may proxy for the unknown part of the fundamental value of the stock in a framework of asymmetric information; iii) the presence of eventual significant differences in the way stocks are evaluated in the US and in European financial markets.

3. The determinants of price earnings for high-tech stocks: descriptive analysis

We build our sample by extracting values of all stocks classified in the US and European high-tech and media industry by DATASTREAM. On the whole, we select 201 US and 245 European stocks (for the list of constituents see Appendix 1). Industries considered are: telecom wireless, telecom fixed line, telecom equipment, software, semiconductors, publishing and printing, media agencies, internet, cable and satellite, computer services and broadcasting.[11]

The database provides information about the following variables (beta, 1-year ahead, 2-year ahead and long term IBES forecasted growth rate, number of earning forecasts in the previous three months and forecasts' standard deviation, twelve trailing months (TTM) sales per share, TTM earning per share, dividend price ratio and special items per share). Data are collected monthly from the January 1995 to May 2002.

A first problem in investigating the relationship between observed and DCF fundamental P/Es is how to treat firms with negative earnings. Using DCF and calculating P/Es for firms with negative earnings (and comparing them with those with positive P/Es) is clearly nonsense. This is because when P/Es turn to negative a discontinuity in ordering arises. Within the range of positive P/E values, lower P/E stocks are expected to be "cheaper". But a stock with a P/E value so low to be negative is definitely not considered as more convenient than a stock with a low positive P/E. Furthermore, a low negative P/E is worse than a high negative P/E so that, again, the ordering is not

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[11] The choice of including in the same sample electronic and communication (publishing and printing, broadcasting) stocks is explained by the definition of Information and Telecommunication Technology revolution itself. This has been generated by the integration of electronic and communication technology which reduced limits to transferability of data, images and information in space. Therefore, we believe that the media industry is part of the revolution together with the electronic industry (as an example, the price of the Italian stock Class affiliated to the media agency industry has risen considerably in the high-tech boom for the revenues from its online information activity).

consistent with that of the positive P/E range where lower P/E stocks are considered cheaper than higher P/E ones. The only solution (generally followed by analysts and financial press) is calculating P/Es in which price is measured in the year t and earnings in the first year (t+i) in which earnings are expected to be positive. The problem is that the first positive earning year varies from stock to stock. Moreover, to allow comparisons with current positive P/E stocks, the latter should be all converted into P_t/E_{t+i} values of the same year t+i. For this reason we decide to limit our analysis to positive earning stocks.

In Tables 1a and 1b we present some descriptive statistics for the overall sample and for the sample containing positive earning firms to have an idea of the costs implied by our choice.[12]

A first inspection at these results clearly shows that distributions of all variables are non normal, some of them including large outliers. We therefore test whether the two samples have different features by looking at medians. By comparing results from Table 1a with those from Table 1b we find that median values of the overall and of the positive earning sample present negligible differences. By contrast, relevant differences arise between US and EU firms. When we perform the test using all sample period observations we reject equality of medians between the US and the EU sample for all variables. When we perform the test month by month the null hypothesis is still rejected most of times. The two variables in which the two samples seem to be more different are the P/E in the positive earning sample (almost 90 percent of times) and the rate of long term growth in both samples (almost 80 percent of times in the positive earning sample).

US positive earnings stocks have a price earning ratio which is higher in median (29.5 against 25) than that of European stocks in the sample period (Table 1b). The difference in mean is highly significant if we look at non overlapping 95 percent confidence intervals. The expected IBES 1-year ahead rate of growth is much more volatile in Europe than in the US. Median values clearly show that 1-year ahead rate of growth forecasts for US stocks are sensibly higher (12 percent against 3

[12] By dropping negative earning stocks the total number of monthly observations in our panel falls from 29080 to 24302. Year by Year medians of the restricted (positive earnings) sample are never significantly different from medians of the overall sample for any of the considered indicators. Results are omitted for reasons of space and available upon request.

percent). The 2-year ahead expected rate of growth seems higher in Europe than in the US in mean but, again, US median is higher than the European one. The long term expected rate of growth is significantly higher in the US than in Europe (20 percent against 15 percent) with outliers being much smaller here than in the two previous cases. Average betas show that US stocks are significantly more sensitive to systematic nondiversifiable risk than European stocks (about 1.1 against 0.8 in both samples).

Even though our two samples are balanced at industry level these descriptive findings clearly illustrate that the multiproduct features of high-tech firms limit the classification properties of industry affiliation. Stock betas, by incorporating effects of these multiproduct features, are therefore better proxies of the effective risk carried by firms in the sample. With this respect, our evidence shows that US companies seem to have a riskier product mix and, consistently with it, they exhibit higher expected rates of growth.

Additional descriptive evidence shows that the number of forecasts per stock is slightly but significantly higher in the US, while their variability is ten times higher in Europe. When looking at firm size we have again large outliers for the European sample. A comparison of the median values indicates that US firms are much bigger than European ones (around 5,190 against 2,900 employees). The inspection of descriptive differences between the two samples highlights other important differences: a much higher share of US firms does not distribute dividends (50 percent against 10 percent in Europe) and, consequently, the dividend price ratio is far smaller in the US than in Europe (1 percent against 15 percent). Special items per share are much more negative in the US (even though the median values show a much less dramatic difference than mean values).

Our inspection at descriptive statistics therefore reveals significant differences between the two samples and leads us to test whether similar differences exist in the way stocks are evaluated in the two markets.

4. The definition of the two hypotheses

The model assumed as a benchmark for our empirical estimates is a textbook DCF model[13] which we expect represents a common standard for fundamentalists.

According to this model - and under the assumption that the discounted cash flow to the firm is equal to net earnings -, the "fundamental price-earning" ratio of the stock may be written as:

$$MV/X = \sum_{t=0}^{\infty} \frac{(1+g_{U,t}^{E})^{t}}{(1+r_{CAPM})^{t}} \qquad (1)$$

where MV is the firm market value, X is the current cash flow to the firm,[14] $g_{U,t}^{E}$ is the expected yearly rate of growth of cash flow, $r_{CAPM} = r_f + \beta(r_m - r_f)$ (2) is the discount rate adopted by equity investors, assumed for simplicity invariant across time, or the expected return from an investment of comparable risk, r_f represents the risk free rate, (r_m-r_f) the expected stock market premium, β is exposure to systematic nondiversifiable risk.

On the basis of this model, we propose to test the following hypothesis.

Hypothesis 1: (Strong relevance of the DCF model). In a market populated by "fundamentalists" with Homogeneous Rational Expectations (HRE) there is an unbiased predictor of the E/P ratio.[15] *This variable is equal to the "fundamental" (discounted cash flow) E/P plus unpredictable noise due to measurement errors and other factors not included in the fundamental E/P.*

The hypothesis of the strong relevance of the DCF model may therefore be tested as:

$$\ln(E/P) = a_0 + a_1 \ln(E/P)^* + \varepsilon \qquad (3)$$

H_0: $a_0=0$, $a_1=1$

where $\ln(E/P)^*$ is the log of the "DCF price earning" ratio calculated as in (1) with earnings (E) replacing cash flow (X).[16] This approximation is necessary since historical records of cash flow

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[13] See for instance Brealey and Myers (1996).

[14] In the well known debate on the relevance/irrelevance of dividends we consider, as large part of the literature, that, under frictionless markets and no transaction costs, the dividend policy does not affect the value of stocks as non distributed dividends become capital gains (Miller-Modigliani, 1961). The value of equity may be equally calculated as the discounted sum of future expected dividends or as the discounted sum of future expected cash flow to the firm.

[15] For HRE we mean that all fundamentalists observe E[g_t], beta, the risk premium and the risk free rate and that all of them agree i) on the observed values and on future predictions for these variables and ii) on the fundamental model of the stock market value described in (1).

[16] The log specification implies that we are testing an equation whose underlying null has nonlinear error term but linear relationship between the two crucial variables (expected and fundamental earning price ratio) or $(E/P) = (E/P)^* \exp(\varepsilon)$.

forecasts are not available. It does not sacrifice too much of the reality under the assumption that expected rate of growth of earnings is a good proxy of the expected rate of growth of cash flow.[17]

Under the null hypothesis $(E/P)^*$ is an unbiased predictor of E/P, the cross-sectional difference between observed and "theoretical" price earning is a zero mean random disturbance, the intercept is not significantly different from zero.[18]

A weaker hypothesis for testing the effects of the fundamental on the observed E/P is the following alternative which takes into account the impact of additional variables helping to predict the variation of E/P not included in the DCF fundamental.

Hypothesis 2: (DCF model adjusted for the asymmetric information). Variables which i) signal the presence of a sustainable competitive advantage and ii) reduce asymmetric information help to predict the variation of the observed E/P not captured by the DCF fundamental.

The specification adopted for testing this hypothesis is the following:

$$\begin{aligned}\ln(E/P)_{jt} &= \alpha_0 + \alpha_1 \ln(E/P)^*_{jt} + \alpha_2 SIZE_{jt} + \alpha_3 \beta_{jt} + \alpha_4 DP_{jt} + \alpha_5 SLS_{jt} + \alpha_6 NUMPE_{jt} + \\ &+ \alpha_7 F1SD_{jt} + \alpha_8 SPITEMS_{jt} + \varepsilon\end{aligned} \tag{4}$$

where *E/P* is the log of the "trailing twelve months" earning per share divided for the closing price of the j-th equity, *(E/ P)** is the log of the earning to price ratio predicted by the DCF model, *Size* is the firm market value, β is the slope of the return of the stock on the return of the S&P 500 index estimated over the last two year on weekly data, *DP* is the dividend price ratio, *SLS* is a variable measuring sales per share, *NUMPE* is a measure of the number of IBES forecasts in the last three months,[19] *F1SD* is the dispersion of analysts' forecasts proxied by the standard deviation of 1-year ahead IBES forecasts and *SPITEMS* is special items per share added to test whether the market penalizes firms having extraordinary components of earnings.

To calculate *(E/P)** we consider the following "two stage growth" approximation of (1):

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[17] The distribution of the E/P variable is extremely skewed and asymmetric if we do not take logs. Another reason for using earning price ratios in logs is that this specification allows to interpret the significance of beta as a measure of the revision of analysts' expectations, when this variable included as an additional regressor (see discussion of equation 8 in section 4).

[18] Note that the existence of fundamentalists only is not sufficient for hypothesis 1 to hold. It is also necessary that there be no limits to arbitrage.

[19] We scale this variable by the number of the firm's employees as its absolute value may also be considered a proxy for firm size and therefore may be a less valid indicator of the extent of brokers' coverage.

$$MVE = X + \sum_{t=1}^{5} \frac{X(1+g_U^E)^t}{(1+r_{CAPM})^t} + \frac{X(1+g_U^E)^6}{(r_{CAPM(TV)} - gn)(1+r_{CAPM})^6} \quad (5)$$

where *MVE* is the "two stage growth" firm market value*, X* is the current cash flow to the firm, g_U^E is the expected yearly rate of growth of earnings[20] according to the consensus of stock analysts,[21] r_{CAPM} is the discount rate adopted by equity investors (see equation 2) where the proxy chosen for the risk free rate is the 3-month government bond rate.[22] For the stock market premium we consider that our measure should be between the historical difference in the rates of return of stocks and T-bonds (between 6 and 9 percent) and the minimum implied premium.[23] This is extremely low (around 2 percent) for US equity markets in the sample period. Both of these two extremes might be incorrect estimates for the risk premium. The former because it assumes that the long term historical premium is equal to the current premium neglecting fundamental institutional and political changes occurred in the last decades.[24] The latter because it assumes that financial markets are correct in evaluating stocks (this is not the case in presence of a bubble or of a nonzero share of noise or liquidity traders trading with arbitrageurs of limited patience).[25] The third addend in (5) is the terminal value of the stock. We arbitrarily fix at the sixth year the shift from the high growth period to the stable growth period. Sensitivity analysis on this threshold shows nonetheless that this choice

[20] Actually, when estimating the model we should use the expected rate of growth of cash flow to the firm instead of the expected rate of growth of earnings. Even though earnings are obviously different from cash flow to the firm, our measure is not biased under the assumption that the expected rate of growth of earnings is not different from the expected rate of growth of cash flow to the firm.

[21] We proxy these expected rates of growth with the 1-year ahead, 2-year ahead and long term IBES expected rate of growth (from the third to the sixth year).

[22] The computational advantage of the "DCF price-earning" is that it is extremely easy to calculate. In fact it does not require the knowledge of the absolute value of company earnings (for firms with positive profits), but only that of five parameters (expected rate of growth of earnings for the high growth period, beta, risk free rate, risk premium and nominal rate of growth of the economy) only two of which are firm specific.

[23] To calculate the current implied premium we use the Gordon et al. (1956) formula in which value is equal to: expected dividends next year/(required return on stocks - expected growth rate). If the formula is correct the observed price can be explained only by a very low risk premium given the observed level of dividends. This implies that investors are ready to pay high prices for the stocks even in presence of low dividends.

[24] The fact that the implied risk premium is lower today than that prevailing in periods (such as the sixties) with similar growth and inflation rates may depend for instance on political factors such as the end of the "cold war" which may make investors' expectations more optimistic over long time horizons therefore reducing the risk of equity investment.

[25] If we just adopt the implied risk premium without weighting it for the historical risk premium, we would implicitly assume that no fundamental value exists or that the fundamental is just what investors believe in that period. In this way changes in the implied risk premium constantly update the fundamental value and the latter becomes just what investors are willing to pay for the stock.

is not so crucial for the determination of the value of the stock.[26] We must in fact consider that the positive impact on value of an additional year of high growth must be traded off with a heavier discount of the terminal value which represents a significant part of the final value. In the terminal value it is assumed that the stock cannot grow more and cannot be riskier than the rest of the economy. Therefore *gn* is the nominal average rate of growth of the economy and $r_{CAPM(TV)}=r_n=$ $r_f + E[r_m - r_f]$.

Based on our theoretical assumptions we justify the introduction of additional variables in our specification as follows: with regard to the *DP* variable the typical dividend discounted fundamental model predicts the variable to be negatively related to the earning price ratio (Cho, 1994; Penman, 1996 and Ohlson, 1995). Since most firms in the sample have a zero dividend policy we assume here that the dividend effect should be absorbed by our fundamental earning price ratio, dividends should proxy for the permanent component of earnings under asymmetric information and, therefore, for the capacity of management to maintain competitiveness (Cho, 1994). This is the reason why we include this variable here.[27] We consider *SLS* as a proxy for firm expected market share as well. *SIZE* is a proxy for both market share and liquidity, the latter being a relevant control factor in the determination of stock value. *NUMPE* reduces the problem of asymmetric information in the observation of firm fundamental as it is regarded as nonlinearly and positively related to the speed of adjustment of prices to new information (Brennan-Jegadeesh-Swaminathan, 1993) and as positively related to the accuracy of earnings predictions (Firth-Gift,1999).[28] *FISD* is a direct measure of nonhomogeneity of analysts' predictions which may be interpreted as a sign of additional noise or reduced information on the firm, *SPITEMS* tests whether the use of extraordinary items is perceived by investors as a device to hide permanent changes in earnings, β

[26] Information on this sensitivity analysis is available from the authors upon request.

[27] The inclusion of the DP variable is a further reason to focus only on positive earning firms. Suppose, as we do, that the firm's dividend policy is completely exogenous to its P/E ratio. The problem here is that a dividend policy is not directly observable: only dividends can be observed. On the other hand, it is clear that negative earning firms are forced to distribute zero dividends whatever their dividend policy is. This would introduce some endogeneity between the proxy variable (dividend to price) and the dependent variable.

[28] To this point some authors find that NYSE listing, by increasing the number of recommending brokers, augments firm visibility with positive effects on its market value (Baker-Powell-Weaver, 1999a and 1999b).

tests for the presence of a forecasting error in the realised earning to price variable net of its negative effect in the DCF already incorporated in *(E/P)**.

To see why assume, following Beaver and Morse (1978), that the standard CAPM holds:

$$r_{it} = r_f + \gamma_i \left(r_{mt} - r_f \right) + u_{it} \tag{6}$$

and assume also that agents make their forecasts on the grounds of the information (Ω) available at time t-1. Hence the forecast error is:

$$r_{it} - {}_{t-1}r^e_{it} = \gamma_i \left(r_{mt} - {}_{t-1}r^e_{mt} \right) + u_{it} \tag{7}$$

where ${}_{t-1}r^e_{it} = E\left[r_{it} \mid \Omega_{t+1} \right]$. This, in turns, implies:

$$p_{it} = {}_{t-1}p^e_{it} + \gamma_i \left(p_{mt} - {}_{t-1}p^e_{mt} \right) + u_{it} \tag{8}$$

where $p_{it} = r_{it} + p_{it-1}$ is the log-price and we used the fact that p_{it-1} is known at time t-1. Let then e_i and e_m be respectively the (assumed constant)[29] log-earnings for the i-th firm and for the market. Rewrite then (8) as:

$$e_i - p_{it} = e_i - {}_{t-1}p^e_{it} - \gamma_i \left(p_{mt} - e_m + e_m - {}_{t-1}p^e_{mt} \right) + u_{it} \tag{8'}$$

taking into account our definition of fundamental value in (1) we may rewrite (8') as:

$$\ln \frac{E_i}{P_{it}} = \ln \left(\frac{E_i}{P_{it}} \right)^* + \gamma_i \left(\ln \frac{E_m}{P_{mt}} - \ln \left[\frac{E_m}{P_{mt}} \right]^* \right) + u_{it} \tag{9}$$

where $P_t \equiv \exp p_t$ and $E_t \equiv \exp \; e_t$. Therefore, say, a negative coefficient of beta in the regression reflects a negative surprise in the market log earnings-price ratio. Notice from (5) that the way we computed $\ln\left(E_i / P_{it} \right)^*$ already accounted for beta. The effect given by (9) is a further effect due to the forecast error. Hence, omitting beta in the regression yields biased estimates unless the market earnings-price ratio is correctly forecasted. Those two effects cannot be separated when we estimate the unrestricted version of the model in Tables 2a-2b.

5. Estimation methods and econometric findings

Since we are interested in a cross-sectional rule which helps investors to select stocks for their portfolios, based on information about the fundamental value, we follow two approaches to estimate our model. First, we propose a mean group estimator (henceforth MGE) approach (Pesaran-Smith, 1995) which tests the significance of time series averages of cross-sectional regression parameters using confidence intervals based on their time series standard deviations (for applications in finance see also Fama-French 2000). A benefit of this approach is that time series standard errors of coefficients take into account the error due to the correlation of residuals across firms. This approach is superior to panel fixed effect estimates when the assumptions of an individual firm effect constant across time or of common slopes for different periods are too restrictive, as it is likely to be the case for our financial data (Pesaran-Smith, 1999). On the other hand, the limit of MGE is that, if slopes are autocorrelated, the time series average slope is in general non normal and its sample variance is biased. To overcome such problems, we reestimate the model as a cross-section for each time unit and verify variations in significance of the estimated coefficients with sensitivity analysis. We also carefully select our variables to avoid endogeneity problems: size is one month lagged firm market value, while other variables should not be endogenous under reasonable assumptions.[30] Moreover, to check the robustness of the significance of different regressors to changes in our specification we progressively introduce them in the estimates.

Since significant divergences among analysts may occur on the rate of growth in the terminal period and, above all, on the risk premium (depending on the choice between historical and implied risk premium and on the different periods selected for estimating the historical risk premium), we start by estimating "fundamental" price earning ratios on different combinations of terminal rate of

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[29]This assumption can be easily relaxed if earnings are generated by the process: $e_{it} - {}_{t-1}e^{e}_{it} = \gamma_i \left(e_{mt} - {}_{t-1}e^{e}_{mt}\right) + v_{it}$.

[30] Institutional investors are usually divided between growth and value portfolio strategies and therefore their share should not be univocally influenced by the observed price earnings. In the same way, the number of recommending brokers is not expected to be influenced by the dependent variable.

growth and risk premium values under the constraint of a discount rate higher than the growth rate of the stock in the terminal value. Results of the test on hypothesis 1 (equation 2) are presented in tables 2a (US market) and 2b (European market).

The model fits well in the US sample where, under the MGE approach, we cannot reject the null that the coefficient of the fundamental is different from one and the coefficient of the intercept is different from zero (hypothesis 1) for a large range of values of the two calibration parameters. The average estimated fundamental coefficient is between .88 and .89 percent reaching the highest value when the risk premium is set at 5 percent and the terminal rate of growth at 2.5 percent (Table 2a). Since the intercept is significantly different from zero in some cross-sectional estimates, the cross-sectional analysis is much more severe than the MGE estimate on the acceptance of the joint hypothesis ($a_0=0, a_1=1$) which is not rejected only in almost 25 percent of cases.

Results from the European sample are quite different and show an average fundamental coefficient between .48 and .54 with much higher standard deviation (namely, in MGEs, high variability of the coefficient itself in different cross-sectional estimates) (Table 2b). By applying the MGE approach to the European sample we find that the 99 percent confidence interval is large, slightly above zero but including the unit value only in very few cases. The highest coefficient is obtained when (E/P)* is calculated with an 8 percent risk premium and a 2.5 percent terminal rate of growth. The intercept is negative and significantly different from zero. A comparison between US and European findings therefore seems to show that the fundamental is a reference value in the determination of the observed E/P in US much more than in Europe and that the highest correspondence between observed and fundamental E/P occurs in US at a relatively lower risk premium. We will test more specifically these two conclusions in the rest of the paper.

We introduce additional variables in order to test hypothesis 2. For each subsample, we select the combination of risk premium and terminal rate which sets the coefficient on (E/P)* closest to 1 (cfr. calibration tables 2a and 2b). Results are shown in tables 3a and 3b). None of these variables appear significant when we use MGEs standard deviations. Remembering that the estimation of the standard error with the MGE approach may be upward biased (under the reasonable assumption of positive slope autocorrelation) we evaluate the significance of additional variables in cross-sectional estimates and find that some of them are significant, even though in limited time spells. If we look in the same tables at the cross-sectional significance of the different parameters we find results which are consistent with those presented in the calibration estimates (Tables 2a and 2b). The coefficient of the fundamental remains around .90, and is significant in all cross-sectional estimates, while the intercept is significant only in 8 percent of cross-sectional estimates when we introduce additional regressors. In Europe the coefficient of the fundamental is around .5 and not significantly different from zero in 10 percent of cross-sectional estimates while the intercept is generally significant more than 70 percent of times. Results on additional regressors confirm that the MGE is too severe in evaluating the significance of some of them. Beta is significant and negative about half of times in both markets. The negative effect of beta supports the hypothesis that, in the considered sample period, earning price ratios were affected by upward revisions of the expected market earning price ratio and therefore by increasing optimism over market perspectives (see equation 8, section 4).[31]

To test whether the two observed differences between the US and European stock markets are significant when stocks of the two samples are jointly considered we reestimate the model presented in Table 3a on the pooled (US and European) sample. In the new regression we calculate the fundamental according to the best US calibration values and add a slope dummy for European stock (EUFUND which is the product of (E/P)* and a dummy taking value of one for European stocks and zero otherwise). We also add a variable (EUDIFFFUND) which is the product of a dummy for European stocks and the difference between the fundamental E/P ratios calculated with the best calibration US and European risk premia (respectively 5 and 8 percent). Since European stocks have their best calibration value at a 3 percent higher risk premium, EUDIFFFUND

[31] A preliminary empirical analysis on weekly data on a restricted period for the US sample shows a higher significance of additional regressors emphasising the higher role of these variables (and presumably of asymmetric information) in short run changes of stock prices (Adriani-Becchetti, 2003).

measures whether the hypothesis that European stocks are evaluated at a higher risk premium holds (Table 4). More specifically, a positive EUDIFFUND evidences that, the higher the difference in (E/P)* between the US (5 percent risk premium) and the European (8 percent risk premium) evaluation, the higher the effect on the observed E/P. Both the EUFUND and EUDIFFUND variables are significant and with the expected signs in more than half of cross-sectional estimates. This result confirms that the hypothesis on the differences in the role of fundamental and in risk premia between the two markets hold for significant time spells.

A final evaluation on the predictive power of our fundamental earning price ratio is performed by replacing (E/P)* with 1-year ahead and long term IBES expected rate of growth in hypothesis two with a specification similar to those adopted in the past literature (Beaver and Morse, 1978; Cho, 1994). Econometric results reported in Tables 5a-5b show that, even though the new variables are significant in the expected direction, the model goodness of fit is highly reduced, especially in the US case where it looses at least 26 percent points when we consider only 1-year ahead forecasts and 11 percent points when we consider also long term forecasts. This result confirms that the DCF fundamental brings additional valuable information for predicting E/P with respect to simple earning growth forecasts.

6. Conclusions

The problem of the evaluation of intangibles, above all in the high-tech industry, is a crucial concern of accountants, investors and financial regulators. In this paper we wonder whether traditional approaches adopted by financial analysts, such as DCF models, are still a useful benchmark for stock market evaluation. We do so by analyzing the relationship between observed and DCF fundamental earning price ratios for stocks from the industry which is allegedly more sensitive to the issue, the high-tech industry.

The analysis on the determinants of E/P dispersion on a sample of high-tech firms presented in this paper shows that the fundamental E/P, evaluated with a traditional DCF model, has almost a one-to-one effect in the US on the observed E/P when the model is calibrated on the observed historical risk premia. The fundamental E/P is also shown to have superior explanatory power with respect to simpler measures of expected earning growth usually adopted in the literature. The strong significance of the DCF variable shows that the evaluation of fundamentals plays a crucial role in determining observed values, even though the relevance of additional variables implies that something is missing in the traditional DCF evaluation.

Our analysis also highlights significant differences between the US and the European markets. Descriptive evidence shows that US stocks are riskier, have higher expected rates of growth and distribute less dividends. Moreover, they have higher coverage from analysts and their growth estimates have lower standard deviation. Econometric evidence shows that the relationship between DCF fundamental and observed E/P is significantly lower for European stocks and the risk premium used for evaluating stocks significantly higher for a large part of the sample period.

A plausible interpretation is that these comparative findings are determined by differences in regulatory environments (i. e. disclosure rules) and the composition of financial market investors. The more pervasive presence of pension funds may for instance be expected to increase the share of long term investors adopting a fundamentalist perspective and also to reduce risk premia given their different approach to investment.

Our empirical results also suggest new directions for testing stock market anomalies. It is not low P/E portfolios but portfolios of stocks with a positive difference between "theoretical DCF" and observed price earnings which should exhibit excess return after risk adjustment, if fundamentals matter and are gravity centers to which observed values converge over time. A more sophisticated approach should be that of estimating a fundamental value of price earning. Contrarian portfolios should therefore include stocks whose fundamental (DCF plus variables correcting for asymmetric information) value is higher than the observed value. In fact, if the stock market is populated by patient fundamentalists and "trend-following chartists" short term deviations from fundamental values should be absorbed in reasonable time spells making the above described contrarian strategies profitable.

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Table 1a. **Descriptive statistics on the most relevant financial variables for US and European high-tech stocks (overall sample)**

							Test Equality of Medians			Percentiles							
		Mean	Standard dev.	Skewness	Kurtosis	Median	Pearson Chi2	Probability	Significance per month*	1%	5%	10%	25%	75%	90%	95%	99%
US	EG1	0.584	7.317	47.324	2593.526	0.12				-2.448	-0.723	-0.365	-0.028	0.3784	1.125	2.2222	9
EU	EG1	0.508	12.738	47.562	3564.998	0.0349	466.817	0.000	46.06	-3.024	-0.8	-0.489	-0.221	0.244	0.7211	1.7273	10.75
US	2-year growth	0.262	2.376	7.937	960.418	0.2179		0.000		-3.533	-0.833	-0.247	0.1295	0.3571	0.6957	1.1333	5.1667
EU	2-year growth	0.496	6.709	38.586	1911.619	0.1818	287.106		59.55	-3.346	-0.889	-0.152	0.1	0.3125	0.6435	1.2093	7.9787
US	LTG	0.229	0.110	1.546	7.300	0.2	1857.398	0.000		0.08	0.1	0.12	0.15	0.275	0.385	0.45	0.55
EU	LTG	0.178	0.217	12.058	397.038	0.15			100	-0.03	0.05	0.0708	0.1	0.2	0.307	0.4079	0.7997
US	Beta	1.264	0.610	0.893	3.954	1.1577	945.828	0.000		0.2648	0.4807	0.5875	0.8157	1.6107	2.0964	2.4124	3.0987
EU	Beta	0.923	0.646	0.526	4.051	0.8221			76.40	-0.17	0.0746	0.2086	0.4486	1.3137	1.8018	2.1176	2.6598
US	NUMPE	13.873	8.649	0.900	3.388	12	236.535	0.000		2	3	4	7	19	26	31	39
EU	NUMPE	12.264	9.720	1.063	3.542	10			37.07	1	1	2	5	18	27	33	40
US	F1SD	0.063	0.138	7.627	90.374	0.03	6693.812	0.000		0	0	0.007	0.01	0.06	0.14	0.23	0.69
EU	F1SD	0.722	1.788	12.020	289.393	0.18			100	0	0.01	0.02	0.06	0.68	1.78	3.11	7.37
US	SIZE	16906	36171	4.550	28.952	5190	395.726	0.000		155	320	569	1700	12999	39600	86700	192550
EU	SIZE	16303	39264	3.920	19.968	2900			39.32	0	65	202	760.5	10283	39085	101553	216006
US	SPITEMS	-27.758	2753.962	-25.710	777.049	-0.0063	3224.453	0.000		-46.77	-11.04	-2.915	-0.527	0	0	0.1919	3.1445
EU	SPITEMS	1.707	119.427	11.696	158.071	0			94.38	-5.724	-0.925	-0.333	-0.041	0.0591	0.9362	5	0.9362
US	SLS	80.876	973.613	5.184	35.500	10.733	526.108	0.000		0.0488	0.3473	0.8853	3.2248	33.643	138.21	304.07	1446.5
EU	SLS	250.749	10351.980	8.168	77.237	6.2036			53.93	0.1667	0.4365	0.7987	1.9877	34.33	123.16	400.41	2592.8
US	DP	0.010	0.041	7.222	64.017	0	4021.687	0.000		0	0	0	0	0.0092	0.0281	0.0489	0.1224
EU	DP	0.156	11.903	7.086	67.552	0.0002			94.38	0	0	0	2E-05	0.0095	0.0513	0.1326	0.6024

* Number of months in which the cross-section EU median value is significantly different from the cross-section US median value at the 95 per cent significance level (percent values)
Variable legend: EG1: average 1-year ahead IBES forecast of the rate of growth of earnings per share; 2-year growth: average 2-year ahead IBES forecast of the rate of growth of earnings per share; LTG: average long term IBES forecast of the rate of growth of earnings per share. F1SD is the dispersion of analysts forecasts proxied by the standard deviation of 1-year ahead IBES forecasts, SIZE is the number of firm employees, SPITEMS is special items per share; SLS is a variable measuring sales per share, DP is the dividend price ratio.

Table 1b. Descriptive statistics on the most relevant financial variables for US and European high-tech stocks (positive earning firms)

							Equality of Medians test			Percentiles							
		Mean	Standard dev.	Skewness	Kurtosis	Median	Pearson chi2	Probability	Significance per month*	1%	5%	10%	25%	75%	90%	95%	99%
US	Obs. P\E ratio	63.084	207.674	18.193	446.581	29.525	1014.23	0.000		7.393	11.394	14.310	19.479	50.554	101.297	170.895	555.000
EU	Obs. P\E ratio	68.307	632.731	50.211	2905.776	25			89.88	4.757	9.031	11.835	16.934	42.225	80.862	148.148	738.333
US	Log (P\E)	3.534	.858	1.288	6.170	3.385	1014.23	0.000		2.000	2.433	2.661	2.969	3.923	4.618	5.141	6.319
EU	Log (P\E)	3.360	.914	1.282	7.907	3.219			89.88	1.560	2.200	2.471	2.829	3.743	4.393	4.998	6.604
US	EG1	0.584	7.316	47.322	2593.526	0.12	466.817	0.000		-2.448	-0.722	-0.364	-0.027	0.378	1.125	2.222	9
EU	EG1	0.508	12.739	47.564	3564.688	.0348			29.21	-3.024	-0.8	-0.489	-0.221	0.244	0.721	1.727	10.75
US	2-year growth	0.277	2.034	8.726	2009.684	0.22	287.106	0.000		-2.078	-0.141	-0.083	0.146	0.329	0.567	0.886	3
EU	2-year growth	0.525	6.169	40.376	2142.41	.187			49.43	-2.809	-.24	0.029	0.113	0.307	0.581	1	7.8
US	LTG	21.766	9.588	1.241	5.355139	20	1857.398	0.000		8	10	11.5	15	25	35	40	50
EU	LTG	18.229	21.049	15.093	465.7918	15			79.77	-0.12	5.16	7.5	10	20	31.22	41.34	79.97
US	Beta	1.199	0.551	0.742	3.337	1.101	945.828	0.000		0.278	0.474	0.571	0.780	1.549	1.965	2.227	2.713
EU	Beta	.892	0.594	0.659	3.244	.797			71.91	-0.133	0.081	0.209	0.442	1.271	1.719	2.009	2.438
US	NUMPE	14.042	8.716	.925	3.423	12	236.535	0.000		2	3	5	7	19	27	31	39
EU	NUMPE	12.697	9.860	1.003397	3.380	10			34.83	1	1	2	5	18	28	33	40
US	F1SD	0.051	0.117	10.482	167.021	0.02	6693.812	0.000		0	0	.005	.01	.05	0.1	0.17	0.51
EU	F1SD	0.564	1.090	4.968	41.081	.17			100	0	.01	.02	.05	.59	1.48	2.34	5.31
US	SIZE	16658.53	35361.9	4.541	28.993	5290	395.726	0.000		148	319	566	1726	12920	39400	86700	192550
EU	SIZE	17137.98	40302.18	3.784	18.721	3205			31.46	0	62	200	782	10838	41527	104966	217320
US	SPITEMS	-33.080	3022.914	-97.670	9540.692	-.001	3224.453	0.000		-54.35	-10.58	-2.841	-4.952	0	0	.153	2.846
EU	SPITEMS	1.798	123.615	-57.6221	4010.602	0			94.38	-5.724	-1.221	-.342	-0.468	.062	1.142	5.494	28.462
US	SLS	78.289	1062.293	91.646	8873.960	10.487	526.108	0.000		.043	.277	.873	3.225	32.025	125.357	266.127	1371.705
EU	SLS	274.787	10856.04	93.851	9180.842	7.357			53.93	.177	.500	.874	2.297	37.290	153.284	458.587	2870.903
US	DP	0.018	0.051	7.562	68.037	0	4021.687	0.000		0	0	0	0	0.0102	0.0321	0.0519	0.162
EU	DP	0.19	15.303	7.012	64.532	0.0002			94.38	0	0	0	0.001	0.0087	0.0592	0.1526	0.704

* Number of months in which the cross-section EU median value is significantly different from the cross-section US median value at the 95 percent significance level (percent values)

Variable legend: EG1: average 1-year ahead IBES forecast of the rate of growth of earnings per share; 2-year growth: average 2-year ahead IBES forecast of the rate of growth of earnings per share; LTG: average long term IBES forecast of the rate of growth of earnings per share. F1SD is the dispersion of analysts forecasts proxied by the standard deviation of 1-year ahead IBES forecasts, SIZE is the number of firm employees, SPITEMS is special items per share; SLS is a variable measuring sales per share; DP is the dividend price ratio.

Tab. 2a The effect of theoretical on observed price earning under calibration of the risk premia and the terminal rate of growth – US sample

Terminal Rate of growth		RISK PREMIA					
		0.04	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
0.025	**E/P***	0.894	0.897	0.893	0.856	0.852	0.828
	s.e.	0.158	0.158	0.168	0.188	0.163	0.173
	Cross-sectional significance (percent value)**	100	100	100	100	100	100
	Constant	-0.264	-0.411	-0.561	-0.804	-0.921	-1.085
	s.e.	0.462	0.447	0.471	0.557	0.477	0.497
	Cross-sectional significance (percent value)**	41.57	49.44	53.93	68.54	85.39	91.01
	Average R^2	0.59	0.57	0.56	0.52	0.51	0.49
	F-Test on the Joint hypothesis (H_0: $\alpha_0 = 0, \alpha_1 = 1$) (Cr.S.signif.)	13.48	27.35	25.84	10.11	0.00	0.00
0.03	**E/P***	0.891	0.894	0.890	0.871	0.846	0.829
	s.e.	0.158	0.158	0.168	0.188	0.165	0.167
	Cross-sectional significance ** (percent value)	100	100	100	100	100	100
	Constant	-0.214	-0.372	-0.529	-0.720	-0.912	-1.056
	s.e.	0.469	0.451	0.475	0.535	0.497	0.475
	Cross-sectional significance ** (percent value)	35.96	42.70	51.69	66.29	82.02	91.01
	Average R^2	0.59	0.58	0.56	0.53	0.51	0.49
	F-Test on the Joint hypothesis (H_0: $\alpha_0 = 0, \alpha_1 = 1$) (Cr.S.signif.)	10.11	16.85	26.97	13.48	2.25	0.00
0.035	**E/P***	0.888	0.891	0.888	0.871	0.849	0.819
	s.e.	0.158	0.158	0.169	0.190	0.174	0.179
	Cross-sectional significance (percent value)**	100	100	100	100	100	100
	Constant	-0.159	-0.329	-0.495	-0.683	-0.874	-1.060
	s.e.	0.479	0.456	0.483	0.538	0.507	0.518
	Cross-sectional significance (percent value)**	31.46	40.45	49.44	62.92	75.28	89.89
	Average R^2	0.59	0.58	0.56	0.53	0.51	0.49
	F-Test on the Joint hypothesis (H_0: $\alpha_0 = 0, \alpha_1 = 1$) (Cr.S.signif.)	11.24	15.73	19.10	20.22	4.49	0.00
0.04	**E/P***	0.885	0.888	0.884	0.867	0.844	0.841
	s.e.	0.158	0.158	0.171	0.195	0.177	0.160
	Cross-sectional significance (percent value)**	100	100	100	100	100	100
	Constant	-0.095	-0.280	-0.460	-0.658	-0.856	-0.972
	s.e.	0.492	0.462	0.499	0.562	0.530	0.465
	Cross-sectional significance (percent value)**	28.09	40.45	46.07	57.30	73.03	86.52
	Average R^2	0.59	0.58	0.56	0.53	0.51	0.50
	F-Test on the Joint hypothesis (H_0: $\alpha_0 = 0, \alpha_1 = 1$) (Cr.S.signif.)	12.36	13.48	22.47	23.60	10.11	0.00

The model tested is $\ln(E/P) = \alpha_0 + \alpha_1 \ln(E/P)^* + \varepsilon$ where *(E/P)** is the "DCF price earning" calculated as in equation (4) of the paper.

** Cross-sect. significance: number of times (in percent values) the coefficient is significant at 99 percent in the 89 monthly cross-sectional estimates of the sample period.

F-Test on the Joint hypothesis (H_0: $\alpha_0 = 0, \alpha_1 = 1$) (Cr.S.signif.): number of times (in percent values) the null hypothesis is not rejected at 99 percent in the 89 monthly cross-sectional estimates of the sample period.

Tab. 2b The effect of theoretical on observed price earning under calibration of the risk premia and the terminal rate of growth – European sample

Terminal Rate of Growth		RISK PREMIA					
		0.04	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
0.025	**E/P***	0.512	0.521	0.526	0.536	0.539	0.538
	s.e.	0.229	0.232	0.233	0.232	0.234	0.233
	Cross-sectional significance (percent value)**	100.00	100.00	100.00	100.00	100.00	100.00
	Constant	-1.504	-1.560	-1.618	-1.657	-1.708	-1.766
	s.e.	0.599	0.566	0.533	0.505	0.484	0.460
	Cross-sectional significance (percent value)**	97.65	100.00	100.00	100.00	100.00	100.00
	Average R^2	0.37	0.36	0.36	0.36	0.35	0.34
	F-Test on the Joint hypothesis (H_0: $\alpha_0 = 0, \alpha_1 = 1$) (Cr.S.signif.)	3.53	5.88	1.18	0.00	0.00	0.00
0.03	**E/P***	0.503	0.518	0.519	0.527	0.536	0.537
	s.e.	0.227	0.231	0.232	0.234	0.232	0.233
	Cross-sectional significance (percent value)**	100.00	100.00	100.00	100.00	100.00	100.00
	Constant	-1.502	-1.539	-1.617	-1.662	-1.700	-1.755
	s.e.	0.605	0.579	0.538	0.514	0.486	0.465
	Cross-sectional significance (percent value)**	96.47	97.65	100.00	100.00	100.00	100.00
	Average R^2	0.36	0.36	0.36	0.36	0.35	0.34
	F-Test on the Joint hypothesis (H_0: $\alpha_0 = 0, \alpha_1 = 1$) (Cr.S.signif.)	3.53	7.06	3.53	0.00	0.00	0.00
0.035	**E/P***	0.492	0.511	0.514	0.521	0.532	0.533
	s.e.	0.224	0.229	0.230	0.232	0.230	0.232
	Cross-sectional significance (percent value)**	100.00	100.00	100.00	100.00	100.00	100.00
	Constant	-1.501	-1.534	-1.608	-1.661	-1.694	-1.750
	s.e.	0.613	0.583	0.544	0.518	0.488	0.468
	Cross-sectional significance (percent value)**	95.29	97.65	100.00	100.00	100.00	100.00
	Average R^2	0.36	0.36	0.36	0.35	0.35	0.34
	F-Test on the Joint hypothesis (H_0: $\alpha_0 = 0, \alpha_1 = 1$) (Cr.S.signif.)	4.71	4.71	4.71	1.18	0.00	0.00
0.04	**E/P***	0.479	0.502	0.512	0.518	0.527	0.529
	s.e.	0.219	0.226	0.229	0.230	0.229	0.230
	Cross-sectional significance (percent value)**	100.00	100.00	100.00	100.00	100.00	100.00
	Constant	-1.505	-1.531	-1.586	-1.646	-1.688	-1.744
	s.e.	0.609	0.589	0.554	0.520	0.492	0.470
	Cross-sectional significance (percent value)**	96.47	97.65	100.00	100.00	100.00	100.00
	Average R^2	0.35	0.36	0.36	0.35	0.35	0.34
	F-Test on the Joint hypothesis (H_0: $\alpha_0 = 0, \alpha_1 = 1$) (Cr.S.signif.)	4.71	3.53	5.88	1.18	0.00	0.00

Legend: see table 2a

Tab. 3a Empirical test of the strong version of the DCF model (hypotheses 1 and 2) in the US stock market

(Dependent variable E/P. Rate of growth in the terminal period 2.5 percent, risk premium 5 percent)

	Mean group estimators							
Const	-0.41	-0.22	-0.04	-0.06	-0.07	-0.06	-0.08	-0.09
s.e.	0.45	0.52	0.44	0.37	0.35	0.35	0.36	0.37
Cross-sect. significance	44.94	35.71	25.00	8.33	8.33	7.14	7.14	8.33
E/P*	0.90	0.96	0.91	0.91	0.91	0.92	0.91	0.91
s.e.	0.16	0.18	0.11	0.10	0.10	0.10	0.10	0.11
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
MV		3.4E-07	-2.8E-01	1.6E-07	-7.1E-07	-6.9E-07	-6.9E-07	-7.2E-07
s.e.		1.1E-06	2.5E-01	1.4E-06	2.4E-06	2.4E-06	2.4E-06	2.3E-06
Cross-sect. significance		1.19	3.57	8.33	20.24	16.67	19.05	16.67
Beta			-0.28	-0.27	-0.25	-0.24	-0.23	-0.24
s.e.			0.25	0.26	0.25	0.26	0.26	0.26
Cross-sect. significance			63.10	52.38	51.19	53.57	50.00	47.62
DP				2.27	2.67	2.90	2.95	2.96
s.e.				3.62	3.71	3.81	3.78	3.42
Cross-sect. significance				4.76	3.57	3.57	3.57	2.38
SLS					0.01	0.01	0.01	0.01
s.e.					0.01	0.01	0.01	0.01
Cross-sect. significance					23.81	20.24	20.24	17.86
NUMPE						0.00	0.00	0.00
s.e.						0.01	0.01	0.01
Cross-sect. significance						2.38	2.38	3.57
F1SD							0.23	0.24
s.e.							0.47	0.51
Cross-sect. significance							3.57	4.76
SPITEMS								-0.03
s.e.								0.30
Cross-sect. significance								4.76
R^2	0.57	0.59	0.64	0.65	0.66	0.66	0.67	0.67

The table shows the time series averages of cross-sectional slopes of equation (3) with their time series standard deviation for the overall sample period (January 1985 to May 2002). *(E/P)** is the log of the DCF price earning ratio computed as in (4) where the terminal rate of growth set at 2.5 percent and the risk premium at 5 percent. *MV* is firm market value, β is the slope of the return of the stock on the return of the S&P 500 index estimated over the last two year on weekly data, *DP* is the dividend price ratio, *SLS* is a variable measuring sales per share, *NUMPE* is a measure of the number of IBES forecasts in the last three months, *F1SD* is the dispersion of analysts forecasts proxied by the standard deviation of 1-year ahead IBES forecasts and *SPITEMS* is special items per share. Cross-sect. significance: number of times (in percent values) the coefficient is significant at 99 percent in the 89 monthly cross-sectional estimates of the sample period.

Tab. 3b Empirical test of the strong version of the DCF model (hypotheses 1 and 2) in the European stock market.

Dependent variable E/P (rate of growth in the terminal period 2.5 percent, risk premium 8 percent)

	Mean group estimators							
Const	-1.74	-1.608	-1.442	-1.531	-1.570	-1.479	-1.433	-1.439
s.e.	0.47	0.667	0.813	0.867	0.836	0.790	0.817	1.041
Cross-sect. significance	100.00	86.90	73.81	77.38	79.76	78.57	77.38	60.71
E/P*	0.539	0.51	0.46	0.45	0.44	0.45	0.46	0.45
s.e.	0.235	0.26	0.26	0.27	0.26	0.26	0.26	0.27
	95.51	90.48	88.10	84.52	84.52	83.33	83.33	86.90
MV		-5.2E-08	9.65E-07	1.08E-06	1.1E-06	1.34E-06	1.32E-06	-3.2244E-07
s.e.		1.84E-06	2.02E-06	1.98E-06	1.96E-06	2.04E-06	1.94E-06	3.12234E-06
Cross-sect. significance		16.67	23.81	21.43	22.62	23.81	22.62	9.52
Beta			-0.34	-0.31	-0.31	-0.25	-0.26	0.08
s.e.			0.21	0.21	0.21	0.25	0.25	1.06
Cross-sect. significance			57.14	58.33	52.38	40.48	40.48	35.71
DP				2.80	1.55	1.80	1.64	0.23
s.e.				4.90	3.84	4.06	3.90	5.19
Cross-sect. significance				13.10	2.38	1.19	1.19	7.14
SLS					0.03	0.03	0.03	0.03
s.e.					0.09	0.09	0.09	0.09
Cross-sect. significance					9.52	8.33	8.33	7.14
NUMPE						-0.01	-0.01	-0.01
s.e.						0.01	0.01	0.02
Cross-sect. significance						10.71	10.71	2.38
F1SD							-0.03	-0.02
s.e.							0.09	0.69
Cross-sect. significance							3.57	8.33
SPITEMS								1.14
s.e.								3.63
Cross-sect. significance								22.62
R^2	0.35	0.39	0.47	0.51	0.52	0.56	0.57	0.75

Legend: see Table 4a

Tab. 4 The determinants of the observed price earning ratios in the pooled US and European sample

	MEAN GROUP ESTIMATORS									
Const	-0.750	-0.890	-0.746	-0.683	-0.566	-0.572	-0.598	-0.561	-0.491	-0.330
s.e.	0.470	0.417	0.394	0.445	0.437	0.427	0.429	0.399	0.382	0.366
Cross-sect. significance	88.76	89.29	78.57	66.67	57.14	55.95	55.95	54.76	47.62	19.05
E/P*	0.674	0.765	0.806	0.830	0.760	0.767	0.764	0.771	0.789	0.843
s.e.	0.296	0.165	0.154	0.162	0.105	0.105	0.107	0.103	0.100	0.090
Cross-sect. significance	100	100	100	100	100	100	100	100	95.23	91.66
EUFUND		-0.044	-0.193	-0.210	-0.099	-0.129	-0.131	-0.126	-0.160	-0.343
s.e.		0.050	0.128	0.162	0.269	0.291	0.288	0.290	0.300	0.279
Cross-sect. significance		57.14	59.52	60.71	39.29	41.67	42.86	39.29	35.71	52.38
EUDIFFFUND			0.789	0.881	0.474	0.636	0.641	0.613	0.737	1.472
s.e.			0.665	0.829	1.331	1.463	1.466	1.480	1.491	1.338
Cross-sect. significance			48.81	52.38	40.48	42.86	45.24	42.86	34.52	44.05
MV				4.9E-08	2.27E-07	1.67E-07	-2.4E-08	4.8E-09	1.43E-07	1.9E-07
s.e.				1.21E-06	1.25E-06	1.53E-06	2.06E-06	1.99E-06	1.85E-06	1.79E-06
Cross-sect. significance				5.95	13.10	22.62	30.95	23.81	22.62	8.33
Beta					-0.270	-0.252	-0.243	-0.228	-0.229	-0.208
s.e.					0.257	0.261	0.258	0.265	0.270	0.255
Cross-sect. significance					59.52	55.95	52.38	47.62	42.86	40.48
DP						2.264	2.286	2.434	2.271	1.771
s.e.						3.402	3.553	3.744	3.453	2.800
Cross-sect. significance						13.10	20.24	22.62	16.67	5.95
SLS							0.005	0.004	0.004	0.003
s.e.							0.010	0.009	0.007	0.007
Cross-sect. significance							14.29	13.10	13.10	8.33
NUMPE								-0.002	-0.002	-0.002
s.e.								0.005	0.005	0.005
Cross-sect. significance								7.14	7.14	2.38
F1SD									-0.094	0.095
s.e.									0.138	0.270
Cross-sect. significance									8.33	1.19
SPITEMS										-0.022
s.e.										0.164
Cross-sect. significance										5.95
R^2	0.44	0.53	0.54	0.55	0.59	0.61	0.62	0.63	0.63	0.66

The model estimated on the pooled US and European sample is the same described in the legend of Table 4a with the "optimal" US (E/P)* calculated with 5 percent risk premium and 2.5 percent terminal rate of growth. We add to the model two additional regressors: i) EUFOND which is the product of (E/P)* and a dummy taking value of one for European stocks and zero otherwise; ii) EUDIFFFOND which is the product of the same European dummy and the difference between the fundamental E/P ratios calculated respectively for the US and the European sample.

Tab. 5a Empirical test of the weak version of the DCF model (hypotheses 1 and 2) in the US stock market.

Dependent variable E/P. Rate of growth in the terminal period 2.5 percent, risk premium 5 percent

	Mean group estimators								
Const	-3.438	-2.486	-2.453	-2.480	-2.498	-2.515	-2.500	-2.491	-2.480
s.e.	0.254	0.315	0.292	0.303	0.288	0.286	0.290	0.318	0.307
Cross-sect. significance	100	100	100	100	100	100	100	100	95.24
EG1	-0.198	-0.172	-0.238	-0.252	-0.259	-0.266	-0.265	-0.266	-0.268
s.e.	0.120	0.086	0.137	0.152	0.155	0.161	0.162	0.160	0.164
Cross-sect. significance	96.63	96.63	97.62	98.81	98.81	98.81	98.81	97.62	92.86
GLT		-4.424	-4.475	-4.346	-4.180	-4.190	-4.221	-4.235	-4.278
s.e.		1.634	1.627	1.455	1.399	1.400	1.416	1.490	1.461
Cross-sect. significance		100	98.81	100	98.81	98.81	98.81	98.81	95.24
MV			8.4E-07	5.39E-07	4.37E-07	-1.2E-07	-9.607E-08	-1.444E-07	-1.87E-07
s.e.			1.38E-06	1.36E-06	1.81E-06	2.7E-06	2.6666E-06	2.6926E-06	2.183E-06
Cross-sect. significance			9.52	3.57	2.38	7.14	5.95	9.52	7.14
Beta				0.006	-0.013	0.003	0.019	0.022	0.009
s.e.				0.247	0.281	0.278	0.284	0.305	0.321
Cross-sect. significance				32.14	33.33	35.71	35.71	36.90	36.90
DP					0.465	0.704	0.813	0.741	0.590
s.e.					3.366	3.368	3.267	3.301	3.505
Cross-sect. significance					1.19	1.19	0	0	0
SLS						0.005	0.005	0.005	0.006
s.e.						0.011	0.011	0.011	0.010
Cross-sect. significance						9.52	5.95	5.95	8.33
NUMPE							-0.002	-0.002	-0.002
s.e.							0.006	0.005	0.005
Cross-sect. significance							1.19	0.00	1.19
F1SD								-0.012	-0.012
s.e.								0.774	0.817
Cross-sect. significance								11.90	14.29
SPITEMS									0.197
s.e.									0.214
Cross-sect. significance									0
R^2	0.21	0.46	0.52	0.53	0.54	0.55	0.55	0.56	0.57

The table shows the time series averages of cross-sectional slopes of equation (3) with their time series standard deviation for the overall sample period (January 1995- May 2002). *EG1*: 1-year ahead average IBES forecasts of the rate of growth earnings. *GLT*: long term average IBES forecasts of the rate of growth earnings, *MV* is firm market value, *Beta* is the slope of the return of the stock on the return of the S&P 500 index estimated over the last two year on weekly data, *DP* is the dividend price ratio, *SLS* is a variable measuring sales per share, *NUMPE* is a measure of the number of IBES forecasts in the last three months, *F1SD* is the dispersion of analysts forecasts proxied by the standard deviation of 1-year ahead IBES forecasts and *SPITEMS* is special items per share. Cross-sect. significance: number of times (in percent values) the coefficient is significant at 99 percent in the 89 monthly cross-sectional estimates of the sample period.

Tab. 5b Empirical test of the weak version of the DCF model (hypotheses 1 and 2) in the European stock market.

Dependent variable E/P (rate of growth in the terminal period 2.5 percent, risk premium 8 percent)

	Mean group estimators								
Const	-3.250	-2.923	-2.880	-2.678	-2.749	-2.766	-2.616	-2.587	-2.714
s.e.	0.333	0.362	0.351	0.251	0.237	0.244	0.305	0.291	0.624
Cross-sect. significance	100	100	100	100	100	100	97.62	97.62	91.67
EG1	-0.143	-0.144	-0.112	-0.111	-0.109	-0.105	-0.082	-0.083	-0.128
s.e.	0.108	0.121	0.157	0.141	0.135	0.133	0.152	0.153	0.278
Cross-sect. significance	87.64	47.19	42.86	42.86	42.86	40.48	39.29	39.29	39.29
GLT		-1.628	-2.032	-1.680	-1.477	-1.420	-1.729	-1.780	-1.513
s.e.		1.436	1.382	1.377	1.068	1.079	1.106	1.153	2.050
Cross-sect. significance		71.91	66.67	41.67	30.95	21.43	35.71	29.76	14.29
MV			6.58E-07	1.46E-06	1.64E-06	1.62E-06	1.78E-06	1.8054E-06	2.923E-07
s.e.			1.45E-06	1.57E-06	1.72E-06	1.74E-06	1.672E-06	1.6645E-06	3.79E-06
Cross-sect. significance			14.29	20.24	23.81	20.24	22.62	19.05	11.90
Beta				-0.287	-0.266	-0.271	-0.168	-0.157	0.159
s.e.				0.207	0.226	0.235	0.260	0.277	1.277
Cross-sect. significance				44.05	39.29	39.29	28.57	32.14	26.19
DP					2.738	0.823	1.246	1.275	0.362
s.e.					5.509	4.280	4.647	4.632	5.515
Cross-sect. significance					16.67	1.19	2.38	2.38	1.19
SLS						0.050	0.048	0.051	0.043
s.e.						0.129	0.128	0.132	0.126
Cross-sect. significance						14.29	14.29	14.29	9.52
NUMPE							-0.011	-0.013	-0.011
s.e.							0.008	0.008	0.018
Cross-sect. significance							26.19	29.76	3.57
F1SD								-0.023	0.018
s.e.								0.098	0.648
Cross-sect. significance								0.00	4.76
SPITEMS									2.109
s.e.									1.534
Cross-sect. significance									0
R^2	0.20	0.33	0.38	0.45	0.48	0.49	0.55	0.56	0.76

Legend: see table 6a