OBSERVED AND "FUNDAMENTAL" PRICE EARNINGS. IS THERE A DRAGGING ANCHOR FOR HIGH-TECH STOCKS?

1. Introduction

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, near rational) traders (Grossman-Stiglitz, 1980; De Long et al.,1990; Allen-Taylor, 1990; Curcio-Goodhart, 1991).

Having this literature as a reference, the simple but quite general hypothesis adopted by our paper is that the first group of traders tries to evaluate the "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.[1]

It is our opinion that the diffusion and the implementation of financial websites has solved some of the informational problems which could prevent non institutional traders from being fundamentalists. The more information is freely available on the web, the higher is the share of independent traders that are able to solve the fundamental value of the stock and the higher the share of investors which may follow this approach. Therefore, if fundamentalists are an important part of the market, a

[1] 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).

significant part of cross-sectional variation in stock prices or in price/earnings should be explained by the fundamental value of prices or price/earnings.

Within this framework this paper develops a standard "two stage growth" discounted cash flow model, which is expected to be commonly adopted by the so called "fundamentalists", and tests whether cross-sectional and time series variability of price earnings may be explained by it or if additional variables need to be taken into account.[2]

In calculating the fundamental value of the stock we use a set of explanatory variables that are likely to significantly affect price earning ratios but that are not available for long time series. These are the extent of coverage and the "average evaluation" of recommending brokers, the share of firm equity held by institutionals and the Consensus forecast on the six year earnings growth. Our choice of considering these variables generates the cost of working with panels of reduced time dimension. This cost is traded-off with the advantage of exploiting new and partially unexplored information which is presumably evaluated by financial traders in their decision process.[3] This advantage reduces divergences in interpreting the fundamental value and increases the likelihood that our approach closely resembles that most widely adopted by fundamentalists.

The paper is divided into five sections (including introduction and conclusions). The second section presents a short survey of the

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[2] 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).

[3] It is for instance clear the advantage of working with Consensus forecasts of medium term earnings growth which represent a better proxy of effective ex ante traders' expectations than VAR forecasts or effectively realised ex post earning growth. Current databases record long time series for Consensus earning forecasts (see the I/B/E/S database) but not for some of the other variables we use in our empirical analyses (such as the share of institutional owners and the number of recommending brokers).

literature on the determinants of price earnings explaining the marginal contribution of this paper. The third section illustrates a standard DCF model. On the basis of this model three hypotheses are tested: i) strong relevance of the DCF model (only the DCF variable matters); ii) weak relevance of the DCF model (factors correcting for forecasting accuracy and real option value of the stock also matter); iii) different impact of risk on P/E for low and high earning firms. Empirical results presented in the fourth section seem to support the hypothesis that stock values reflect a combination of the DCF value plus a real option value corrected for signals which reduce asymmetric information between firms and investors.

2. *The determinants of P/Es: the state of art and our proposed contribution*

If we 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/earnings 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), of future earnings (Cragg-Malkiel, 1982; Litzenberger-Rao, 1971) or of risk (Ball, 1978).

If, on the contrary, investors' expectations are not homogeneous and rational traders have limited patience low P/Es 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).[4]

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[4] More recent papers have nonetheless shown that, even though expectations may not be homogeneous, there are no profitable trading opportunities which may be exploited by the simple rule of building portfolios of low P/E value

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 favour of alternative hypotheses. An example of a model similar to the DCF is the "dividend discounted" fundamental model developed by Penman (1996) and Ohlson (1995). The implications from their model 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 a dividend discount model is provided by Kim and Koveos (1994) in 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's beta) while the right proxy for the second is analysts' expected growth (and not historical growth). In the same direction Frankel and Lee (1998) show that the estimate of the fundamental value of the stock using I/B/E/S Consensus forecast earnings is a good predictor of the cross-sectional distribution of stock prices.

Many empirical analyses on the determinants of P/Es 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/Es and Zarrowin (1990) shows that cross-sectional differences in forecasted long term growth are the main determinants of variations in P/Es, while beta is not important.

The marginal contribution of this paper to the above mentioned literature is that of directly testing the relevance of a DCF model commonly adopted by pratictioners (even though the model may not represent the unique approach to the fundamental value of a stock). We in fact calculate theoretical price earnings by using one of the most commonly adopted DCF formula and check if it

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stocks. Low P/Es appear in fact to be just a proxy for small size and the small size effect seems the anomaly which matters even though its impact fades in the last two decades (Bagella-Becchetti-Caggese, 1999; Becchetti-Cavallo, 1999).

explains cross-sectional differences in price earnings on a sample of high-tech stocks listed at the Nasdaq, Nyse and Amex stock exchanges. The advantage in following this approach is that we try to explain the risk puzzle by decomposing: i) the negative impact of this variable on the DCF part and ii) its positive impact on the real option part of the stock value. In addition we test the role of previously unexplored variables which may proxy both for the value of the option of expansion and for the unknown part of the fundamental value of the stock in a framework of asymmetric information.

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

We select our information from a list of 15 high-tech industries according to the classification described in the Appendix 1. Our sample includes 590 stocks for which information about the following variables (beta, long term expected growth rate, number of analysts,[5] twelve trailing months (TTM) price to sales per share, return on average equity, TTM earning per share excluded extra-ordinary items, short interest, share of institutional ownership) is available. Data are collected weekly between from the 26th of May 2000 to the 22th of September 2000.[6]

[5] The brokerage analysts considered here belong to the Association of Investment Management and Research (AIMR). These analysts tend to have close relationships with management and therefore some form of private information (the firm may communicate if their forecasts are on target).

[6] Our selection criteria implicitly generate two biases which must be taken into account when commenting our results: i) by removing firms which do not have forecasts on six year earning rates of growth we automatically exclude firms with no analysts and therefore those presumably suffering more from asymmetric information; ii) by estimating beta with daily stock returns of the past 30 months we eliminate firms born in the last 30 months (this means that firms with negative earnings in our sample must be more than two years old).

Table 1 presents descriptive statistics for variables which we will use in the econometric analysis. Profit firms are more than twice as much as loss firms in our sample. The average long term rate of growth is quite high (26 percent) and the distribution is right skewed reflecting a typical feature of high-tech stocks.[7] The average brokers' recommendation is extremely bullish if we consider that a value between 1 and 2 reflects an average evaluation between "buy" and "strong buy". [8] The short ratio evidences that the ratio between short and long positions is extremely low (only two percent of outstanding stocks are shorted on average). While profit firms have on average positive earning surprises and very low subgroup standard deviation, loss firms have a negative earning surprise with much higher standard deviation. These descriptive findings support only for loss firms the hypothesis that analysts are too optimistic (De Bondt-Thaler, 1990; O'Hanlon-Widdet, 1990), while the median surprise so near to zero for profit firms seems to reject this hypothesis for them. [9] Loss firms have expected six year rates of growth higher on average than those of profits firms (33 against 26 percent), are significantly smaller, have a lower share of equity held by institutionals, less covering brokers and reduced momentum. This preliminary evidence therefore indicates that estimates only on profit firms may be affected by a selection bias which does not allow to infer predictions on the overall sample unless this bias is

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[7] Because of the direct relationship between prices and earnings, the sample distribution for earnings-price ratio is also strongly skewed when both profit and loss firms are considered. In spite of this, considering the log earnings-price for profit firms (as we do in econometric estimations) yields a symmetric distribution (i.e. the skewness index shrinks from –7.83 to –0.71)

[8] The variable is the average of the following recommendations: strong buy=1; buy=2, moderate buy=3, hold=4, sell=5.

[9] In comparing our descriptive evidence with previous literature findings we must consider that we analyse short term surprises (differences between forecasted and actual EPS when earnings are released) and not one or two year ahead forecasts as De Bondt and Thaler (1990).

explicitly taken into account with proper econometric techniques (as it will be done in the next sections).

4. *The definition of the three hypotheses*

The model assumed as a benchmark for our empirical estimates is a textbook DCF model[10] 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:

$$VMA/X = \sum_{t=0}^{\infty} \frac{(1+E[g_t])^t}{(1+r_{CAPM})^t} \qquad (1)$$

where *VMA* is the firm market value, *X* is the current cash flow to the firm,[11] $E[g_t]$ is the yearly expected rate of growth of cash flow, $r_{CAPM}= K_e = R_f + bR_m$ is the discount rate adopted by equity investors or the expected return from an investment of comparable risk, R_f represents the risk free rate, R_m the expected stock market premium, *b* is exposition to systematic nondiversifiable risk. 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

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

[11] In the well known debate on the relevance/irrelevance of dividends we consider, as large part of the literature, that, under perfect information and no transaction costs, the dividend policy does not affect the value of stocks as non distributed dividends become capital gains (Miller-Modigliani, 1961; Lintner, 1956). 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. By following this benchmark, though, we will reconsider the relevance of dividend payout as a signal of permanent earnings and therefore as an additional determinant which may affect the observed P/E together with the "theoretical DCF P/E" in a framework of asymmetric information.

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.

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) " and with unlimited possibility of arbitrage a one-to-one relationship exists between observed and DCF price-earnings with no other independent variables affecting the former. For HRE we mean that all fundamental traders observe $E[g_t]$*, beta, the risk premium and the risk free rate, all 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).*[12]

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

$$E/P = a_0 + a_1(E/P)^* + \sum_{i=1}^{n} g_i X_i + e \qquad (2)$$

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

where $(E/P)^*$ is the "DCF price earning" represented by (1) and X_i is the i-th generic independent variable which is assumed to affect price earnings when some of the assumptions contained in hypothesis 1 do not hold. Under the null hypothesis the cross-sectional difference between observed and "theoretical" price earning is a zero mean random disturbance and the intercept is not significantly different from zero. The X_i variables selected to test

[12] Note that the existence of fundamentalists only is not a necessary condition for hypothesis 1 to hold. The necessary condition is the absence of limits to arbitrage.

the null hypothesis may be chosen in order to test the following alternative:

Hypothesis 2: (DCF model adjusted for real option value and asymmetric information). In a framework of asymmetric information in which ownership of a quasiproprietary asset or of a sustainable competitive advantage gives firms the opportunity of making value accretive investments (real options)[13] *which may increase their market value, observed price earnings incorporate the fundamental value calculated as in (1) plus a real option value. Firm market value is therefore enhanced by all those variables which i) signal the ownership of a quasiproprietary asset or of a sustainable competitive advantage and ii) increase precision in the evaluation of the stock under asymmetric information.*

Under hypothesis 2 firm price earning ratio may be rewritten as a weighted sum of the firm specific DCF plus real option value and of the overall market DCF value:

$$VMA/X = \left[\sum_{t=0}^{\infty}\frac{(1+E[g_t])^t}{(1+r_{CAPM})^t}+\frac{CV}{X}\right]f(\Omega)+\left[\sum_{t=0}^{\infty}\frac{(1+E[g_n])^t}{(1+r_n)^t}\right](1-f(\Omega))$$

(3)

where the first term and the second term respectively represent the forecast based on firm-specific and the forecast based on market wide information. $\phi(.)$, the weight given to the first forecast, is a function of variables affecting the precision of the forecast itself. The DCF part of firm value is augmented of the

[13] A real option is intended here as a right to make potentially value accretive investment based on the ownership of a quasiproprietary asset or of a sustainable competitive advantage. For the related literature see (Dixit-Pindick, 1994, Trigeorgis, 1998). Examples of these options are "scale up" options (businesses with sustainable competitive advantage which can scale up later through cost-effective sequential investments as market grows), "switch up" options (option to switch products, process on plants given a shift in the underlying demand) and "scope up" options (investment in proprietary assets enabling the company to enter another industry cost-effectively).

real option part of the value which is modeled as a call option:[14] $CV\left(X_O(Z),t\right)=X_O(Z)\Phi\left(d_1\right)-C*e^{r\left(t-t^*\right)}\Phi\left(d_2\right)$
(4)

according to the well known Black and Scholes (1972) formula where: $d_1=\dfrac{\ln(X_O(Z)/C)+(r+s^2(\boldsymbol{b})/2)T}{s(\boldsymbol{b})\sqrt{T}}$

and $d_2=\dfrac{\ln(X_O(Z)/C)+(r-s^2(b)/2)T}{s(b)\sqrt{T}}$. *CV* is the value of a call which depends on the value of the underlying asset (X_O(Z) (cash flow from expansion), on the strike price (*C*) (cost for expansion), on the variance in the asset value (s) and on time to maturity ($T=t-t^*$) and *F(.)* is the standard normal cumulative distribution function. *Z* is a vector of variables proxying the ownership of a quasiproprietary asset or of a sustainable competitive advantage which gives firms the opportunity of making value accretive investments (and threfore affect the real option value of the stock).

By inspecting (3) it is worth noting that beta appears both in the DCF part and in the real option part of the stock value. An eventually positive and significant beta after its contribution to the fundamental (*E/P*)*, also present as a regressor in the specification, may therefore indicate that the value of the stock includes a significant portion of the real option component in which risk positively affects the value of the stock.

More specifically, if (3) holds, the counterbalancing effect of risk on the fundamental and on the real option part of the stock value leads us to formulate this additional hypothesis:

[14] Our assumption here is that the DCF part includes only earning forecasts for the existing firm business and does not include the option of expansion. Even though this assumption is debatable, we must agree that it may be self fullfilling in stock markets as far as it gains advocates among financial traders and academicians (Luehrman, 1988a and 1988b; Maubousssin, 1999; Copeland-Keenan, 1998Damodaran, 1996; Trigeorgis, 1998, Dixit-Pindick, 1994).

Hypothesis 3: firms with low earnings are likely to have fundamental to real option value ratios which are lower relatively to those of high earning firms. Therefore we expect risk to be positively correlated with price earnings in the former, while not in the latter group of firms.

PROOF: To justify this hypothesis on theoretical grounds consider the following argument. Assume that the market value of the stock is given by the following sum of DCF and real option value as described in (3) where, for simplicity, *f(.)=1*[15] and, consequently, the price earnings ratio is:

$$VMA/X = \sum_{t=0}^{\infty} \frac{(1+E[g_t])^t}{(1+r_{CAPM})^t} + \frac{CV}{X} \qquad (5)$$

where *CV* is given by (4).

By evaluating the derivative of firm price earning with respect to beta we get the following two components:

$$\frac{\partial (VMA/X)}{\partial b} = -\sum_{t=0}^{\infty} t \frac{(1+E[g_t])^t}{(1+r_{CAPM})^{t+1}} R_m + \frac{g(b)}{X} \qquad (6)$$

where $g(b)$ is the derivative of the call option with respect to beta. To find $g(b)$ just consider that:

$\frac{\partial CV}{\partial s} = X_O \sqrt{T} j(d_1)$ where j is the value of the standardised normal distribution. The standard deviation of the expansion project is assumed for simplicity to be equal to the stock standard deviation, X_O is the value of the underlying asset, T is time to maturity, and $d_1 = \frac{\ln(X_O / C) + (r + s^2/2)T}{s\sqrt{T}}$.

[15] This assumption is made only to make our exposition simpler since our proof holds for any value of *f Î]0,1]*.

By assuming that the standard CAPM holds the variance of the expansion project may be decomposed into: $s^2 = b^2 s_M^2 + s_e^2$ or $s = \sqrt{b^2 s_M^2 + s_e^2}$.

It is then possible to calculate:

$$g(b) = \frac{\partial CV}{\partial b} = \frac{\partial CV}{\partial s}\frac{\partial s}{\partial b} =$$

$$= X_0 \sqrt{\frac{T}{2p}} \exp\left\{-\frac{1}{2}\left[\frac{\left(\ln(X_0/C) + \left(r + \frac{1}{2}\left(b^2 s_M^2 + s_e^2\right)T\right)\right)^2}{\left(b^2 s_M^2 + s_e^2\right)T}\right]\right\} \frac{b s_M^2}{\sqrt{b^2 s_M^2 + s_e^2}} \qquad (7)$$

which is always positive for $b>0$.

To demonstrate that the overall effect of b on firm DCF plus real option value depends on current earnings we derive (6) with respect to X. We easily find that:

$\frac{\partial(VMA/X)}{\partial b \partial X} = -\frac{g(b)}{X^2}$ which is always negative for $b>0$. The intuition is that, as earnings grow, the effect of b on the DCF value is higher than that on the option of expansion. Therefore, as earnings grow, the derivative of price-earnings with respect to b goes down.

Equazione 1

From (6) we find that the value of X at which the derivative goes to zero is:

$X^* = \frac{g(b)}{l}$ where $l = \sum_{t=0}^{\infty} t \frac{(1+g_t)^t}{(1+r_{CAPM})^{t+1}} R_m$, Since λ is positive for reasonable values of the discount rate, of future earnings growth rates and of the risk premium, it follows that X^* is positive. This implies that the derivative of price earnings with respect to b becomes negative for a level of current earnings which is higher than zero. A higher b will therefore have an inequivocably positive effect on *P/E* for loss firms and an ambiguous sign for profit firms depending on the level of X^*. ■

To test hypothesis 3 we propose the following specification:

$$(E/P)_{TAIL} = a_0 + a_1 g_U + a_2 b + a_3 b D_{LOW} + \sum_{i=1}^{n} g_i X_i + e$$

$H_0: a_3 < 0$.

where $(E/P)_{TAIL}$ is the earning price observed for the sample of the highest 75 percent and of the lowest 25 percent of profit firms ranked according to their return on equity, g_U is the Consensus forecast on earnings rate of growth and D_{LOW} is a dummy for measuring changes in the effect of beta for the lowest 25 percent of profit firms.

5.1 The econometric specification

In estimating (3) we must consider that agents know only some of its parameters. They in fact observe exposition to systematic non diversifiable risk and some of the indicators contained in the vector of Z-variables affecting firm real option value and the vector of Ω-variables affecting the precision of the firm specific forecast. Therefore we assume that they use the following approximation:

$$E/P = (E/P)^*(1 + q(Z,\Omega)) \cdot \qquad (8)$$

If q is small enough we may approximate (8) as $E/P \approx (E/P)^* e^{q(Z,\Omega)}$ and, by taking logs, we get:

$$\log(E/P) \approx \log(E/P)^* + J(Z,\Omega) \cdot$$

The specification adopted for testing the first hypothesis is therefore the following:

$$(E/P)_{jt} = a_0 + a_1 Size + a_2 (E/P)^*_{jt} + a_3 b_{jt} + a_4 DPO_{jt} + a_5 SLS_{jt} + a_6 NANPE_{jt} + a_7 SHINST_{jt} + e \quad (9)$$

where *Size* is the firm market value, *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 DCF earning to price ratio, *b* is the slope of the return of the stock on the return of the S&P 500 estimated over the last thirty months, *DPO* is the dividend payout, *SLS* is a variable measuring the difference between net sales and earnings scaled by net sales, *NANPE* is a measure of the recommending brokers' intensity (the number of average recommending brokers per firm employee)[16] and *SHINST* is the institutional ownership as a percentage of total stock outstanding.

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

$$VMA = X + \sum_{t=1}^{5} \frac{X(1+E[g_U])^t}{(1+r_{CAPM})^t} + \frac{X(1+E[g_U])^6}{(r_{CAPM(TV)} - gn)(1+r_{CAPM})^6} \quad (10)$$

where *VMA* is the firm market value, *X* is the current cash flow to the firm, $E[g_U]$ is the yearly expected rate of growth of earnings[17] for the next six years according to the Consensus of stock analysts, $r_{CAPM} = K_e = Rf + bR_m$ is the discount rate adopted by equity investors or the expected return from an investment of comparable risk, R_f represents the risk free rate, R_m the stock market expected premium, *b* is exposition to systematic nondiversifiable risk. For the stock market premium we consider

[16] We scale this variable by the number of the firm's employees as its absolute value is considered as a proxy of firm size and therefore should be a less valuable indicator of the extent of brokers' coverage.

[17] 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.

that our measure should be between the historical difference in the rates of return of stocks and T-bonds (between 6 and 7 percent) and the current implied premium[18] for US equity markets in the sample period which is extremely low and around 2 percent. Both of these two extremes might be incorrect estimates for the risk premium. The former assumes that the long term historical premium is equal to the current premium neglecting fundamental institutional and political changes occurred in the last decades[19] and the latter 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).[20] The third addend of the formula 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 also because the sixth is the last year for which we have forecasts from the Consensus of stock analysts. Sensitivity analysis on this threshold shows nonetheless that this choice is not so crucial for the determination of the value of the stock.[21] 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

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[18] To calculate the current implied premium we use the Gordon formula in which value is equal to expected dividends next year/(required return on stocks - expected growth rate). In the light of this formula, the extremely low implicit risk premium in the sample period may be interpreted as the availability to pay higher prices even in presence of low dividend payout.

[19] The fact that the implied risk premium is lower today than 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 holding the stock.

[20] If we would 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.

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

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 $r_{CAPM(TV)} = K_{e(TV)} = Rf + R_m$.

Based on our theoretical assumptions we justify the introduction of additional variables in our specification as follows: with regard to the DPO the typical dividend discounted fundamental model predicts payout to be negatively related to the earning price ratio (Cho, 1994; Penman, 1996 and Ohlson, 1995). Since we assume here that the dividend effect may 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 of maintaining competitiveness which may in turn affect both future earnings and the fundamental value of the option to expand (Cho, 1994). *SLS* is a proxy of firm market share, a factor which is expected to affect the existence of real options of expansion, *SIZE* is a proxy for both market share and liquidity, the latter being a relevant control factor in the determination of stock value, *NANPE* reduces the problem of asymmetric information in the observation of firm fundamental and real option value 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), [22] *SHINST* is a proxy of shareholders' monitoring intensity and therefore is expected to reduce the problem of asymmetric information as well, ***b*** is the proxy of stock volatility which is expected to positively affect the real option value of the stock, net of its negative effect in the DCF part of the stock value already incorporated in the *(E/P)** variable.

[22] 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).

As a final point, to compare our results with those of previous researches (Cho 1994, Beaver and Morse 1978), we estimate an unrestricted version of (9) where *(E/P)** is replaced by its determinants (*b* and E[g_u]).

5.2 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 fundamental and real option value we follow three approaches to estimate our model. First, we propose a mean group estimators approach which tests the significance of time series averages of cross-sectional regression parameters using confidence intervals based on their time series standard deviations (Fama-French 2000). A benefit of this approach is that time series standard errors of coefficients take into account the error due to correlation of residuals across the firms. On the other hand, its limit is that if slopes are autocorrelated, the time series average slope is in general non normal and its sample variance is biased. To avoid such problems we reestimate the model as a cross-section with bootstrap standard errors for each time unit and verify variations in significance and magnitude of the estimated coefficients with an extreme bound analysis (Leamer, 1983). Third, we check whether our results remain robust in a panel between group estimator which adds some structure to the estimate by assuming that cross sectional coefficients are time invariant. We also carefully select our variables to avoid endogeneity problems: size is firm market value at the beginning of the estimation period, while other variables should not be endogenous under reasonable assumptions.[23]

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

Furthermore, 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 relative value of the risk free rate (depending on which asset is considered the best proxy for a risk free asset) and, above all, of 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 theoretical price earnings on different combinations of risk free and risk premium values under the constraint of a discount rate higher than the growth rate of the stock in the terminal value.

The model fits surprisingly well when the risk free rate is set to .05 (to .04) and the risk premium to .07 (to .08) or when both parameters are set to .06, if we consider the first week of the estimation period (Table 2). In these cases, the null hypothesis on the intercept and on the coefficient of the theoretical DCF price earning is not rejected. For all other admissible values of the two parameters the coefficient of $(E/P)^*$ remains not significantly different from one. It is interesting to note that the intercept is higher than zero for combinations of risk premia and risk free rates which are lower than those mentioned above and negative otherwise. This implies that the market evaluates at .12 percent the sum of the two parameters in the period considered in our estimates. A sensitivity analysis using bootstrap standard errors for the 18 weeks by using the .05-.07 combination of parameters respectively for the risk free rate and for the risk premium shows that the joint hypothesis of strong relevance of the DCF model is not rejected for six weeks, while in the other weeks it is rejected as the observed P/E tends to underreact to the fundamental P/E (Table 2b).

These results lead us to two conclusions: i) the DCF model plays a relevant role in explaining cross sectional dispersion of price earnings; ii) underreaction of observed P/E to the "DCF fundamental" does not contradict our assumption that proxies for the unobserved quality and real option value mitigate the role of the fundamental P/E in a framework of asymmetric information.

Table 3 in fact clearly show that results from our extended specification support hypothesis 2 against the alternative.

A first additional variable which is positively and significantly related to the dependent variable is the proxy of the sales to earnings ratio. This result has an asymmetric information and a real option rationale. First, earnings may be easily manipulated and therefore strongly depend on accounting methods. Different rules for depreciation, M&A and R&D accounting (expenditure or investment) may significantly alter earnings comparisons.[24] For this reason, many analysts rely more on net sales to which they apply industry specific net sales/earning ratios to estimate "non manipulated" earnings. Second, net sales to earning ratios may proxy for firm market share which positively affects the fundamental value of the option of expansion (a high market share may imply brand name or first mover technological advantage which are factors generating partial exclusivity on the future option to invest).

The dividend payout is another variable which significantly and positively affects price earnings. Here again, the asymmetric information and the real option rationales apply. The DPO reduces agency costs between managers and shareholders (Easterbrook, 1984) and proxies for the permanent component of earnings and therefore for the capacity of management of maintaining competitiveness which may in turn affect both future earnings and the fundamental value of the option to expand (Cho, 1994)[25]. Finally, as explained above, the significance of the

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[24] Craig, Johnson and Joy (1987) find that firms with conservative accounting methods have higher P/Es. According to several authors (French and Poterba, 1991, Costa and Freitas, 1991) the impressive rise in P/Es of Japanese firms in the '80s is also explained by the accounting methods used for evaluating asset values more than by changes in the dividend payout.

[25] A firm which increases too much the dividend payout ratio may incur into two types of penalties: i) it reduces funds available for reinvestment and therefore

number of recommending brokers and of the equity share held by institutionals are other two important clues that signals of quality matters and that asymmetric information is an important rationale in explaining the effects of different variables on the observed price earnings.

More specifically, the result on institutional ownership is consistent with previous literature findings showing that higher institutional ownership increases momentum on the stock, the likelihood of being targeted and is a substitute of debt as a discipline and signalling device thereby reducing agency costs between managers and holders of firm assets (Jones et al., 1997; Grier-Zychowicz, 1994; Chen-Steiner, 1999, Smith, 1996).

The significance of beta shows that the value of high-tech firms with high growth perspectives may incorporate the value of options for expansion which are actually increased and not reduced by volatility (see the proof of hypothesis 3 in section 3).[26] The nice thing though, is that beta is no more (or, in some cases, weakly) significant in the unrestricted specification in which the contribution of beta is no more evaluated net of the DCF component (Table 4a). This suggests that the joint inclusion of the theoretical P/E and of beta as separate regressors under hypothesis 1 enriches our interpretation on the role of risk on stock value.

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future rates of growth; ii) it may be forced to give a negative signal in the near future when the DPO proves not to be sustainable and needs to be reduced. For this reason Bhattacharya (1979) and Cho (1994) argue that dividend payout is a proxy for the permanent component of earnings.

[26] In interpreting this result we cannot neglect another potential explanation. We may even suppose that an increasing share of noise and daytraders, not so risk averse as long term stockholders, look for large fluctuations in stock value over short time lengths in order to make profitable their short term trades. An example of this may be given by the positive value of stocks which are near to bankruptcy. An interpretation of why these stocks often maintain prices significantly above zero is because of their high volatility and of their gambling option value which attracts risk lovers trying to profit from what is called in jargon a "dead cat bounce". A reduced risk aversion may therefore be an observationally equivalent rationale for the changing role of the beta.

To evaluate the magnitude of the impact of significant regressors on the extended estimate we measure elasticities around the mean of the independent variable in our log-linear specification. These indicate that, after (*E/P*)*, beta has the higher elasticity (.64), followed by the share of institutionals (.32) and by the number of analysts (.12) (Table 3a).

Our sensitivity analysis shows that the significance of all the above mentioned variables used to test hypothesis 1 and 2 seems to be robust to changes in specification as far as new regressors are introduced (tables 3b and 4b). Moreover, extreme bound tests on the extended specification based on cross sectional estimates and bootstrap standard errors show that the model is quite stable across weeks. All variables, with the exception of the DPO variable, are significant for nearly all time periods with a very limited variation in the magnitude of coefficients. Finally, the panel between group estimate (tables 3a and 4a) confirms again our results which are therefore equally produced by three different estimating approaches (mean group estimators, extreme bound cross sectional estimates with bootstrap standard errors, panel within group estimates). It is in fact the same extreme bound analysis that rules out potential biases when using the third approach by showing that the assumption of stability of cross-sectional coefficients across time is suppported by our data.

5.3 Selection bias, prediction on the overall sample and hypothesis 3 testing

Some caveat are needed if we want to extend our findings to the overall sample. Since loss firms - for which the (10) cannot be applied without additional information on costs and revenues dynamics - are likely to be evaluated on different grounds than profit firms (Jaffe et al., 1989), results on hypothesis 1 cannot be used to infer predictions on the whole sample of profit and loss firms. Such predictions may in fact be affected by a selection bias as the significance of the regressors may not be independent from the selection process (which led to the exclusion of loss firms). This suggests a reestimation of regressions presented in tables 3 and 4 following the approach suggested by Heckman (1979) in which regressors include an additional variable. This variable is represented by the Mill's ratio estimated from a probit equation in which the probability of being a profit firm is regressed on a set of potential explanatory variables. In this way the potential endogeneity generated by the selection bias (potential nonzero correlation between the residuals of the determinants of the nonrandom selection and the residuals of the determinants of the earning price ratio among the selected individuals) is taken into account.

The underlying assumption for the estimation of an Heckman selection model[27] may be justified as follows. Consider what happens when the observed earning/price ratio differs from the "operational earning price"[28] which fundamentalists take into account for their trading decisions. The model therefore becomes:

$$(E/P)_O = \begin{Bmatrix} E/P & \text{if } EPS \geq 0 \\ \text{not observed} & \text{otherwise} \end{Bmatrix}$$

By defining I_{jt} as a dummy which takes value of 1 if the j-th firm has positive earnings at time t we may specify the model as follows:

[27] Characteristics of our data require the adoption of a Heckman model and do not allow estimating a truncated or a censored regression model. This is because we dispose here of a set of observed independent variables for those firms for which the dependent variable is not observed. In addition, when the dependent is beyond the threshold value it is just not defined and does not assume the threshold value itself.

[28] An example could be the widely followed practice of using industry earnings to compute "operational price earnings" of loss firms. This choice has rational grounds if we assume that losses are transitory and that the potential capacity of generating earnings for loss firms may be proxied by the capacity of the related industry

i) Selection Mechanism: $EPS_{jt} = d_0 + \sum_{i=1}^{m} d_i W_{ijt} + u_{jt}$

$$I_{jt} = \begin{cases} 1 & \text{if } EPS_{jt} > 0 \\ 0 & \text{otherwise} \end{cases}$$

where *Wit* is the i-th independent variable which affects earnings at time t.

ii) Regression Model:

$$(E/P)_{Ojt} = a_0 + a_1 (E/P)^{*}_{jt} + \sum_{i=1}^{n} g_i X_{ijt} + q\, l_{jt} + e_{jt} \qquad \text{if } I_j = 1$$

where $\hat{l}_{jt} = \dfrac{j(\hat{d}_0 + \sum_{i=1}^{m} \hat{d}_i W_{ijt})}{\Phi(\hat{d}_0 + \sum_{i=1}^{m} \hat{d}_i W_{ijt})}$ is the Mill's ratio for the

predicted probability of being a profit firm obtained from the selection mechanism estimated as a probit.

The variables chosen and assumed to affect the cross-sectional probability of being a profit firm are size, age (number of years since listing), beta, expected growth rate and sales.[29]

[29] The vector of regressors (X) affecting the dependent variable in the regression model is generally a subset of the vector of regressors (W) affecting the selection mechanism. The rationale is the idea that the dependent variable affects the selection mechanism. Therefore if regressors affect the dependent variable they must also affect the selection mechanism. In our case it is impossible to follow this approach. Some variables (*E/P*, SLS, DPO*) are not defined for loss firms (although some of their determinants are defined and included in the Mill's estimation), while others (*SHINST, NANPE*) more than affecting the profitability status are affected by it. On the other hand, a partial benefit in ruling out these variables from the selection mechanism is that the noncoincidence of W and X solves the identificability problem of X and l (Leung and Yu 1996) in the two stage procedure.

Econometric findings from hypothesis 1 estimated with a two stage Heckman model which takes into account the potential selection bias are consistent with the hypothesis of dependence of the regression equation from the selection mechanism (tab. 5a and 5b)[30] since the Mill's ratio is significantly negative in the extended regression (this indicates that being a profit firm adds value to the stock *per se*). Nevertheless, results on the significance of various regressors coefficients in tables 5a and 5b do not contradict what found and commented in tables 3 and 4.

Finally, in testing hypothesis 3, again a problem of selection bias arises since the selection factor (ROE) might be in principle affected by the outcome of the dependent variable (E/P). For this reason we add to model specification Mill's ratios to correct for the bias following the two stage Heckman (1979) selection model. In this case the set of variables used to estimate the Mill's ratio is composed by log of (E/P)*, Size, beta, sales, leverage, age and dividend payout.

Testing hypothesis 3 gives also us the opportunity to compare predictions of the real options hypothesis with those of the risk loving hypothesis, in order to distinguish between two observationally equivalent rationales for the significance of beta in hyp. 2 (see footnote 26). Since the latter predicts that value (E/P) should always increase (decrease) as beta increases no matter of the firm's ROE, we can formulate the alternative hypothesis:H_1 : (risk loving) $a_2 < 0$; $a_3 = 0$.

Results from tab. 6 show that the null of hypothesis 3 cannot be rejected and nicely confirm the different impact of beta for low and high positive earning firms. Beta is in fact positive (but not significant) on the earning price ratio for high profit firms which have presumably a relatively higher current profit/option value ratio, while negative (and significant) for low profit firms.

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[30] The significance of regressors coefficients in the Heckman specification is also consistent with what found when testing hypotheses 1 and 2 (tab. 2 and 3).

On the other hand, the same evidence seems to reject the risk loving rationale for the role of beta in explaining value. In fact, the risk loving hypothesis fails to explain why the value doesn't increase with beta for high ROE firms.

5. Conclusions

The analysis on the determinants of P/E dispersion on a sample of high-tech firms shows that the fundamental P/E evaluated with a traditional DCF model has a one-to-one effect on the observed P/E when the model is calibrated on the observed historical risk premia. The strong significance of the DCF variable shows that the evaluation of fundamentals plays a strong role in determining observed values, even though the relevance of additional variables implies that something is missing in the traditional DCF evaluation. The increasing underreaction of observed to fundamental earning price ratios as far as additional regressors (such as dividend payout, sales to earning ratios, number of recommending brokers and risk) are introduced and the significance of such regressors support the hypothesis that DCF evaluations occur under imperfect information and are therefore corrected for signals of firm "sustainable competitive advantage" and for proxies of the value of the option to expand.

Another nice result here is the positive and significant effect of risk out of the DCF theoretical P/E (in which risk is negatively correlated with the observed price earning) and the higher value of risk for low earning than for high earning firms. These two results are consistent with the hypothesis that stocks are evaluated with a fundamental plus real option element with risk affecting stock value negatively in the first element and positively in the second. The observed findings also rule out two observationally equivalent hypotheses explaining our results on beta (overestimation of the risk premium and presence of risk loving traders). The first rationale is not sufficient to explain why beta significance disappears when we replace the fundamental E/P with the expected rate of growth of earnings in the estimate and the second rationale does not explain why the effect of beta is stronger among low return stocks (hypothesis 3).

Our paper rises further questions which suggest new directions for future research. Since our observation period is quite limited we do not know if we identified a long run law of the stock market or if we simply took a picture of a transitory bubble. In both case, even if we may have doubts on classifying what we observed, we must conclude that we could measure it with "enhanced tools" which helped us to discriminate among different component of stock value which, in the observation period, have been believed to affect prices by financial traders.

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 as the sum of the DCF and the real option value of the stock itself where the latter is proxied by a chosen combination of the variables which we find relevant in our estimates (beta, net sales to earning ratios, short interest, number of recommending brokers and dividend payouts). Contrarian portfolios should therefore include stocks whose fundamental (DCF plus real option) 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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Tab.1 Selected percentiles of the distributions of variable used in econometric estimates

	Mean	S.E.	Median	1%	5%	10%	25%	75%	90%	95%	99%
ALL (9612)											
E/P	-0.017	0.178	0.015	-0.702	-0.232	-0.106	-0.007	0.038	0.069	0.090	0.141
BETA	1.191	0.735	1.130	-0.510	0.100	0.340	0.710	1.630	2.120	2.530	3.200
AGE	7.851	4.527	7	2	3	3	4	10	14	16	23
MV	8756.2	35894.2	918.2	39.6	77.0	128.7	329.2	2982.7	12078.7	26794.1	188697.5
SHINST	54.863	22.637	56.71	4.09	13.6	23.02	38.86	72.69	83.64	87.85	95
N. AN.	7.684	6.372	6	1	1	2	3	10	17	22	29
g_U	28.148	17.249	25	0	12.5	15	19.33	33.75	45	50.42	78
AVR	1.793	0.512	1.67	1	1	1.24	1.43	2	2.5	3	3
BK	7.255	6.171	5.914	0.729	1.305	2.005	3.571	9.050	13.377	16.843	27.532
Pchart	0.590	0.237	0.606	0.112	0.197	0.257	0.396	0.782	0.907	0.953	0.992
ES	-0.904	22.452	0.037	-14.5	-4.22	-1.762	-0.261	0.269	0.779	1.9	15.353
PROFIT (6756)											
	Mean	**S.E.**	**Median**	**1%**	**5%**	**10%**	**25%**	**75%**		**95%**	**99%**
E/P	0.037	0.037	0.026	0.001	0.003	0.006	0.013	0.052	0.080	0.099	0.156
BETA	1.200	0.667	1.13	-0.05	0.21	0.42	0.75	1.62	2.09	2.42	2.98
AGE	8.554	4.836	8	2	3	3	5	10	16	17	23
MV	11671.6	42277.5	1382.8	53.9	138.8	212.8	476.6	4157.1	15888.2	56331.3	232121.3
SHINST	59.494	20.964	62.105	6.44	20.99	30.49	44.72	75.725	85.58	89.2	95
N. AN.	8.672	6.627	6	1	2	3	4	11	19	23	31
GU	25.785	10.374	24	9	12.75	15	18.75	30.83	40	45	60
AVR	1.735	0.455	1.67	1	1.14	1.25	1.4	2	2.4	2.6	3
BK	7.826	5.190	6.661	1.135	2.155	2.754	4.335	10.126	14.290	17.413	24.688
ES	0.697	6.342	0.067	-3.55	-1.35	-0.66	-0.03	0.271	0.779	2.188	16.046
Pchart	0.647	0.217	0.668	0.159	0.260	0.334	0.489	0.822	0.928	0.965	0.995
DPO	3.053	18.356	0	0	0	0	0	0	3.88	18.8	53.76
SLS	0.870	0.168	0.908	0.270	0.661	0.744	0.843	0.954	0.978	0.988	0.996
LOSS (2820)											
	Mean	**S.E.**	**Median**	**1%**	**5%**	**10%**	**25%**	**75%**	**90%**	**95%**	**99%**
E/P	-0.146	0.283	-0.046	-1.520	-0.576	-0.397	-0.160	-0.013	-0.004	-0.002	-0.001

BETA	1.171	0.876	1.14	-0.85	-0.14	0.11	0.58	1.69	2.32	2.69	3.81
AGE	6.175	3.100	5	2	2	3	4	8	10	11	16
MV	1859.9	6367.2	384.1	29.9	55.8	71.0	147.8	1103.5	2739.4	7892.8	40714.3
SHINST	43.910	22.682	44.11	1.91	7	13.05	25.67	60.895	75.71	80.71	92.33
N. AN.	5.348	5.001	4	1	1	1	2	7	11	16	26
g_U	33.737	26.505	28	0	10	14	20	43.75	51.15	60.63	188.5
AVR	1.930	0.604	1.8	1	1	1.2	1.5	2.4	3	3	3
BK	5.902	7.866	4.596	0.466	0.852	1.172	2.231	7.440	10.470	15.321	38.878
Pchart	0.457	0.228	0.418	0.086	0.140	0.183	0.275	0.632	0.788	0.872	0.963
ES	-4.763	40.1	-0.27	-49.17	-11.8	-6.1	-1.73	0.248	0.947	1.649	4.4

E/P is the observed earning price ratio, *BETA* is the slope of the return of the stock on the return of the S&P 500 estimated over the last thirty months, *AGE* is firm years of listing, *MV* is firm market value, *DPO* is the dividend payout, *SHINST* is institutional ownership as a percentage of total stock outstanding , *N. AN.* is the number of recommending brokers, g_U the six year expected rate of growth according to Consensus forecasts, *AVR* is the firm's average brokers' recommendation (strong buy=1; buy=2, moderate buy=3, hold=4, sell=5), *SHR* is the "short interest" of the number of shares short in the current month to the average total number of shares traded daily in the same month, *BK* is the book value of the firm in *t-1*,*ES* is the earning surprise calculated as the percent difference between actual and I/B/E/S expected earnings, *SLS* is a variable measuring the difference between net sales and earnings scaled by net sales, Pchart is the distance of price to highest price.

Tab. 2a The effect of theoretical on observed price earning under calibration of the risk free and the risk premium rates

Rf	Rm-Rf	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.1	0.11	0.12
	Coef.	-	-	1.1087	1.1062	1.0937	1.0720	1.0425	1.0067	0.9660	0.9223	0.8768	0.8306
0.04	**s.e.**			*0.091**	*0.094**	*0.097**	*0.100**	*0.103**	*0.105**	*0.107**	*0.108**	*0.110**	*0.112**
	Const.			2.4568	1.6445	1.1107	0.6794	0.3009	-0.043	-0.360	-0.653	-0.923	-1.171
	s.e.			*0.509**	*0.460**	*0.433**	*0.4146*	*0.400*	*0.388*	*0.377*	*0.366*	*0.356**	*0.347**
	R-sq.			0.2640	0.2500	0.2336	0.2165	0.1989	0.1813	0.1641	0.1477	0.1323	0.1180
	Test			960.63	350.63	130.78	38.88	4.88	1.15	14.46	37.76	67.00	99.77
	$a_0 = 0, a_1 =$			0.000	0.000	0.000	0.000	0.008	0.318	0.000	0.000	0.000	0.000
	Coef.	-	1.1186	1.1274	1.1258	1.1142	1.0934	1.0645	1.0293	0.9892	0.9457	0.9002	0.8540
0.05	**s.e.**		*0.089**	*0.092**	*0.096**	*0.099**	*0.102**	*0.105**	*0.107**	*0.109**	*0.111**	*0.113**	*0.114**
	Const.		2.5247	1.7600	1.2644	0.8636	0.5074	0.1781	-0.131	-0.422	-0.696	-0.951	-1.187
	s.e.		*0.498**	*0.452**	*0.427**	*0.410**	*0.398*	*0.387*	*0.377*	*0.368*	*0.359*	*0.351**	*0.342**
	R-sq.		0.2770	0.2646	0.2501	0.2342	0.2173	0.1999	0.1824	0.1654	0.1491	0.1338	0.1196
	Test		989.33	364.72	137.95	42.19	6.01	1.08	13.80	36.83	65.97	98.71	133.49
	$a_0 = 0, a_1 =$		0.000	0.000	0.000	0.000	0.003	0.339	0.000	0.000	0.000	0.000	0.000
	Coef.	1.1174	1.1372	1.1468	1.1461	1.1353	1.1152	1.0870	1.0524	1.0127	0.9694	0.9241	0.8778
0.06	**s.e.**	*0.086**	*0.090**	*0.094**	*0.097**	*0.101**	*0.104**	*0.106**	*0.109**	*0.111**	*0.113**	*0.115**	*0.116**
	Const.	2.5304	1.8191	1.3692	1.006	0.6805	0.3738	0.0800	-0.203	-0.473	-0.730	-0.972	-1.199
	s.e.	*0.487**	*0.443**	*0.420**	*0.405**	*0.394*	*0.384*	*0.376*	*0.368*	*0.361*	*0.353**	*0.346**	*0.338**
	R-sq.	0.2871	0.2771	0.2648	0.2505	0.2348	0.2180	0.2008	0.1836	0.1667	0.1505	0.1353	0.1211
	Test	1015.5	378.28	145.15	45.70	7.37	1.28	13.42	36.23	65.34	98.12	132.95	168.81
	$a_0 = 0, a_1 =$	0.000	0.000	0.000	0.000	0.001	0.284	0.000	0.000	0.000	0.000	0.000	0.000

The model tested is $E/P = a_0 + a_1 \left(E/P\right)^* + e$ where *(E/P)** is the "DCF price earning" calculated as in equation (1) of the paper.

Tab. 2b Sensitivity analysis of calibration for the 18 weeks (risk free rate set at 5 percent and risk premium at 7 percent)

Week number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Constant	0.292	0.267	0.642	1.039	1.171	1.316	1.305	1.069	0.922
s.e	0.406	0.406	0.429	0.436	0.434	0.433	0.440	0.439	0.431
Boots. s.e.	0.485	0.476	0.531	0.496	0.484	0.492	0.486	0.512	0.502
(E/P)*	1.096	1.069	1.218	1.334	1.363	1.402	1.405	1.339	1.309
s.e	0.110	0.110	0.116	0.119	0.118	0.118	0.120	0.119	0.117
Boots. s.e.	0.135	0.132	0.147	0.138	0.135	0.137	0.135	0.142	0.139
Joint hypothesis Test (H0: $a_0 = 0, a_1 = 1$)	0.130	0.840	7.550	26.060	19.600	18.800	6.590	13.770	30.630
(1- P-value for the rejection of the null)	0.875	0.435	0.001	0.000	0.000	0.000	0.002	0.000	0.000

Week number	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Constant	0.929	0.926	0.705	-0.016	0.641	0.682	0.540	0.960	1.195
s.e	0.390	0.391	0.416	0.390	0.413	0.417	0.419	0.421	0.438
Boots. s.e.	0.443	0.449	0.558	0.535	0.561	0.571	0.582	0.552	0.573
(E/P)*	1.244	1.243	1.193	1.000	1.192	1.216	1.176	1.274	1.331
s.e	0.106	0.106	0.113	0.107	0.112	0.113	0.114	0.115	0.120
Boots. s.e.	0.124	0.126	0.156	0.149	0.157	0.160	0.163	0.155	0.162
Joint hypothesis Test (H0: $a_0 = 0, a_1 = 1$)	4.430	1.630	3.210	1.500	0.960	8.210	10.140	0.780	11.810
(1- P-value for the rejection of the null)	0.013	0.197	0.042	0.225	0.383	0.000	0.000	0.460	0.000

Tab. 3a Empirical test of the strong version of the DCF model (hypotheses 1 and 2) - dependent variable E/P (average cross-section slopes with time series standard deviation)

	Mean group estimators							Panel between groups estimates
Const	0.8101	0.9753	2.0931	2.2456	4.3331	4.0335	4.5639	5.4519
s.e.	0.3730*	0.5260	0.4792*	0.3567*	0.5155*	0.5344*	0.5212*	0.5152*
E/P*	1.2447	1.0919	1.4105	1.4461	1.5852	1.4526	1.4931	1.7041
s.e.	0.1133*	0.4099*	0.1273*	0.0969*	0.1059*	0.1106*	0.1087*	0.1071*
MV		-0.0034	-0.0026	-0.0026	-0.0032	-0.0038	-0.0041	-0.0037
s.e.		0.0003*	0.0002*	0.0003*	0.0002*	0.0003*	0.0003*	0.0009*
Beta			-0.5321	-0.5458	-0.5841	-0.5409	-0.5406	-0.6027
s.e.			0.0751*	0.0572*	0.0484*	0.0557*	0.0546*	0.0602*
Dpo				0.0180	0.0253	0.0232	0.0240	-0.0124
s.e.				0.0346	0.0424	0.0405	0.0408	0.0032*
Sls					-1.7581	-1.9047	-1.9326	-2.0511
s.e.					0.2190*	0.2697*	0.2604*	0.2415*
Nanpe						-12.6298	-12.8334	-8.9806
s.e.						3.5508*	3.4534*	3.1177*
Shinst							-0.0059	-0.0058
s.e.							0.0006*	0.0019*
Var.	**E/P***	**nanpe**	**beta**	**sls**	**MV**	**Shinst**	**dpo**	
VIF	1.3000	1.2800	1.1200	1.0900	1.0600	1.0400	1.0300	
1/VIF	0.7674	0.7826	0.8962	0.9201	0.9416	0.9640	0.9669	
Elasticity around $\overline{X}$		0.12	0.64	0.02	0.03	0.32	0.05	
Mean VIF	1.13							

The table shows the time series averages of cross-sectional slopes of equation (9) with their time series standard deviation for the overall sample period (26th of May to 22nd of September). Between group estimates are reported in the last column. *(E/P)** is the log of the DCF price earnings computed as in (10) where the risk free rate is set at 0.05 and the risk premium at 0.07. *MV* is firm market value, *BETA* is the slope of the return of the stock on the return of the S&P 500 estimated over the last thirty months, *DPO* is the dividend payout, *SLS* is a variable measuring the difference between net sales and earnings scaled by net sales, *NANPE* is a measure of the recommending brokers' intensity (the number of recommending brokers), *SHINST* is institutional ownership as a percentage of total stock outstanding.
VIF (variance inflation factor): 1//1-R(x) where R(x) is the R squared when the independent variable x is regressed on all other independent variables (Marquardt, 1970).

Tab. 3b Extreme bound sensitivity analysis - strong version of the DCF model (cross-sectional estimate with bootstrap standard errors)

Variable	Significant coefficient of minimum magnitude (boostrasp s.e.)	Significant coefficient of maximum magnitude (boostrasp s.e.)	Number of weeks in which the regressor has significant coefficients
(E/P)*	1.174 (0.150*)	1.652 (0.141*)	18
MV	-0.005 (0.001*)	-0.004 (0.001*)	18
Beta	-0.600 (0.080*)	-0.392 (0.076*)	18
Dpo	-0.005 (0.001*)	-0.008 (0.004*)	3
Sls	-2.373 (0.280*)	-1.589 (0.603*)	18
Nanpe	-21.695 (4.604*)	-9.474 (4.489*)	16
Shinst	-0.007 (0.002*)	-0.005 (0.002*)	18
Constant	3.466 (0.710*)	5.451 (0.649*)	18

The table reports maximum and minimum slopes (with bootstrap standard errors) of the cross-sectional regression of equation (9) for the overall sample period (26th of May to 22nd of September). Reported slopes are those different from zero at the 95% level using bootstrap confidence interval. The last column shows the number of week in which the null of selected slope equal to zero was rejected at the 95% level.

Tab. 4a Empirical test of a weaker version of the DCF model

Var.	Mean group estimators							Panel between group estimates
Cost.	-2.1836	-2.1567	-2.1138	-2.0685	-0.4009	-0.3011	0.1011	0.3547
s.e.	0.1074*	0.1049*	0.1073*	0.0896*	0.2707	0.3184	0.3119	0.2884
gu	-0.0603	-0.0602	-0.0587	-0.0598	-0.0655	-0.0600	-0.0616	-0.0704
s.e.	0.0057*	0.0056*	0.0053*	0.0040*	0.0043*	0.0045*	0.0044*	0.0045*
MV		-0.0027	-0.0026	-0.0026	-0.0032	-0.0038	-0.0041	-0.0037
s.e.		0.0003*	0.0002*	0.0003*	0.0002*	0.0003*	0.0003*	0.0009*
Beta			-0.0696	-0.0720	-0.0649	-0.0649	-0.0517	-0.0449
s.e.			0.0553	0.0519	0.0508	0.0534	0.0512	0.0603
Dpo				0.0231	0.0309	0.0284	0.0294	-0.0119
s.e.				0.0404	0.0489	0.0464	0.0470	0.0032*
Sls					-1.7531	-1.9036	-1.9307	-2.0460
s.e.					0.2329*	0.2857*	0.2769*	0.2422*
nampe						-12.8769	-13.0967	-9.0772
s.e.						3.6471*	3.5529*	3.1258*
shinst							-0.0059	-0.0057
s.e.							0.0006*	0.0019*
Var.	**gu**	**nampe**	**beta**	**sls**	**MV**	**shinst**	**dpo**	
VIF	1.4000	1.2700	1.1400	1.0900	1.0600	1.0400	1.0300	
1/VIF	0.7128	0.7848	0.8767	0.9204	0.9416	0.9648	0.9683	
Mean VIF	1.1500							

The table shows the time series averages of cross-sectional slopes of equation (9) with their time series standard deviation for the overall sample period (26th of May to 22nd of September). Between group estimates are reported in the last column. Variable legend: g_U the six year expected rate of growth according to Consensus forecasts, *MV* is firm market value, *BETA* is the slope of the return of the stock on the return of the S&P 500 estimated over the last thirty months, *DPO* is the dividend payout, *SLS* is a variable measuring the difference between net sales and earnings scaled by net sales, *NANPE* is a measure of the recommending brokers' intensity (the number of recommending brokers), *SHINST* is institutional ownership as a percentage of total stock outstanding.
VIF (variance inflation factor): 1//1-R(x) where R(x) is the R squared when the independent variable x is regressed on all other independent variables (Marquardt, 1970).

Tab. 4b Extreme bound sensitivity analysis - weak version of the DCF model - (cross-sectional estimate with bootstrap standard errors)

Variable	Significant coefficient of minimum magnitude (boostrasp s.e.)	Significant coefficient of maximum magnitude (boostrasp s.e.)	Number of weeks in which the regressor has significant coefficients
gu	-0.069 (0.006*)	-0.050 (0.006*)	18
MV	-0.005 (0.001*)	-0.004 (0.001*)	18
Beta	-0.123 (0.080)	0.050 (0.067)	0
Dpo	-0.007 (0.004*)	0.121 (0.058*)	4
Sls	-2.397 (0.275*)	-1.570 (0.594*)	18
Nanpe	-21.717 (4.540*)	-9.586 (4.673*)	16
Shinst	-0.007 (0.002*)	-0.005 (0.002*)	18
Constant	-0.387 (0.609)	0.550 (0.344)	

Tab. 5a **Heckman selection model of the determinant of the earning price ratio**

Var.							
a_0	0.6922	0.5180	1.9348	2.0403	3.9723	3.8101	4.3426
s.e.	0.3565	0.3299	0.4473*	0.3405*	0.5205*	0.5362*	0.4889*
(E/P)*	1.1962	1.0955	1.3564	1.3735	1.4158	1.3546	1.3579
s.e.	0.1086*	0.0998*	0.1264*	0.1066*	0.1111*	0.1107*	0.1031*
Mill	-0.1464	-0.4844	-0.1480	-0.1882	-0.4918	-0.3163	-0.4778
s.e.	0.0578*	0.0601*	0.0947	0.1223	0.1330*	0.1250*	0.1313*
MV		-0.0043	-0.0029	-0.0029	-0.0043	-0.0044	-0.0051
s.e.		0.0003*	0.0004*	0.0004*	0.0004*	0.0004*	0.0005*
Beta			-0.5177	-0.5272	-0.5522	-0.5228	-0.5173
s.e.			0.0767*	0.0661*	0.0615*	0.0610*	0.0607*
Dpo				0.0217	0.0256	0.0251	0.0243
s.e.				0.0404	0.0437	0.0430	0.0418
Sls					-1.8466	-1.9361	-1.9944
s.e.					0.2619*	0.2884*	0.2802*
Nanpe						-11.3063	-10.7173
s.e.						2.7566*	2.3504*
Shinst							-0.0068
s.e.							0.0005*

Tab. 5b **Heckman selection model of the determinant of the earning price ratio**

Var.							
a_0	-2.1932	-2.1448	-2.0895	-2.0334	-0.2052	-0.1846	0.3329
s.e.	0.1049*	0.0968*	0.0990*	0.0827*	0.2733	0.3044	0.3005
gu	-0.0621	-0.0587	-0.0562	-0.0569	-0.0587	-0.0562	-0.0563
s.e.	0.0065*	0.0065*	0.0061*	0.0054*	0.0055*	0.0054*	0.0052*
Mill	0.1294	-0.1138	-0.1706	-0.2136	-0.5187	-0.3466	-0.5090
s.e.	0.0735	0.0892	0.0982	0.1260	0.1387*	0.1289*	0.1270*
MV		-0.0029	-0.0029	-0.0030	-0.0043	-0.0044	-0.0051
s.e.		0.0004*	0.0004*	0.0004*	0.0004*	0.0004*	0.0005*
Beta			-0.0799	-0.0845	-0.0950	-0.0856	-0.0797
s.e.			0.0601	0.0558	0.0588	0.0606	0.0593
Dpo				0.0211	0.0252	0.0248	0.0241
s.e.				0.0388	0.0432	0.0428	0.0415
Sls					-1.8701	-1.9603	-2.0172
s.e.					0.2410*	0.2772*	0.2667*
Nanpe						-11.0512	-10.4336
s.e.						2.8519*	2.3793*
Shinst							-0.1078
s.e.							0.5863

Legend to tables 5a and 5b The tables present results on estimation of equation (9) with the Heckman's two stage method. The set of variables chosen for the selection mechanism (profit or loss firm) includes size, beta, expected growth, sales (last twelve months) and age (number of years from date of listing). Mill's ratios estimation has been performed for each week in the sample period. For those weeks, equation (9) has been then estimated with the addition of the Mill variable. Reported slopes are time series averages with their time series standard deviations. E/P* is calculated with a risk premium of 0.07 and a risk free rate of 0.05.

Tab. 6 Test on Hypothesis 3 (the different impact of beta on high and low positive earning stocks)

Variable	Coefficient	s.e.
gu	-0.0550	0.0047*
MV	-0.0058	0.0005*
BETA	0.0823	0.0694
BETALOW	-0.4417	0.1264*
DPO	0.0246	0.0393
SLS	0.1281	1.9617
NANPE	-10.9929	2.0437*
SHINST	-0.0070	0.0006*
MILL	0.1149	0.0576*
ALFA	-2.0813	1.9439

Variable legend: g_U is the six year expected rate of growth according to Consensus forecasts, *MV* is firm market value, *BETA* is the slope of the return of the stock on the return of the S&P 500 estimated over the last thirty months, BETALOW is a variable which assumes the value of firm beta if the stock is in the 25 percent of profit stocks with the lowest ROE and zero otherwise, *DPO* is the dividend payout, *SLS* is a variable measuring the difference between net sales and earnings scaled by net sales, *SHR* is the "short interest" of the number of shares short in the current month to the average total number of shares traded daily in the same month, *NANPE* is a measure of the recommending brokers' intensity (the number of recommending brokers), *SHINST* is institutional ownership as a percentage of total stock outstanding.
MILL is the Mill's ratio from the Heckman's two stage method. The set of variables chosen for the selection mechanism (High or Low ROE) is composed by (E/P)*, Size, Beta, expected growth, sales (last twelve months), age (number of years from date of listing), leverage and dividend payout. Mill's ratios estimation has been performed for each week in the sample period. For the same periood, equation (9) has been then estimated with the addition of the Mill variable. Reported slopes are time series average with their time series standard deviations. E/P* is calculated with a risk premium of 0.07 and a risk free rate of 0.05.

Appendix 1: The high-tech industries selected for the formation of the sample

Yahoo classification	***INDUSTRY***
COMP-MICRO	Computer Hardware
MED-WHSL DRG/SN	Biotechnology & Drugs
COMP-SERVICES	Computer Services
ELEC COMP-SEMIC	Semiconductors
ELEC COMP-MISC	Electronic Instr. & Controls
TELECOMM EQUIP	Communications Equipment
COMP-SOFTWARE	Software & Programming
ELEC MSRNG INST	Scientific & Technical Instr.
COMP-STORAGE DV	Computer Peripherals
COMP-NETWORKS	Computer Networks
COMP-STORAGE DV	Computer Storage Devices
OFFICE AUTOMATN	Office Equipment
PHOTO EQP &SUPP	Photography
RETAIL-CONS ELC	Retail (Technology)
AUDIO/VIDEO PRD	Audio & Video Equipment