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# Determinants of Price to Earnings Multiple Around the World. Recent Findings

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*This article deals with the functioning of capital markets, notably the impact of financial crisis on earnings' pricing rationality. Through a global market based analysis it intends to test the effects of dividend ratios and other fundamentals on P/E multiple, in order to show some recent useful evidences. Starting from a classic theoretical premise (SHV Dividend Discount Model), the article sets out some consequent hypotheses and develops a linear multivariate econometric model to detect (for major quoted companies from US, Australia / New Zealand / Canada, Europe, Japan and Emerging Markets) the actual role of the most important relative valuation multiple determinants during a 'critical period'. Indeed, the analysis refers to 2010, a peculiar year (immediately after the explosion of the Global Financial Crisis) which shows signals of both a weak recovery and a persisting uncertainty. Our findings, likely due to some distortions created by the crisis aftermath, do not fully confirm the SHV-DDM theoretical conjectures about the above said determinants. While the conjectured negative association between P/E and dividend yields seems to be confirmed, the positive association between P/E and payouts does not. Other relevant indicators (risk, roe/growth, leverage and corporate tax rate) are considered in the empirical model as control variables to complete the exploratory analysis. In sum, the paper may appear timely to ascertain the extent of the first and leading effects of the recent global crisis on the rational earnings' pricing models.*

**JEL Codes:** G30, G35 and M41

## 1. Introduction

It is well known that the relative equity valuation *P/E multiple* is given by the ratio *Market Price per Share / Earnings per Share*.[1] It represents one of the most common indicators to judge the worth of firms.

Fundamentals, instead, are qualitative and quantitative information which contribute to the financial understanding and valuation of companies. Given the above, the aim of this paper is to investigate how to regress the price to earnings multiple upon its fundamental determinants. Empirical observations will make it possible to verify what influence the 'underlying' P/E *drivers* have been recently able to exert.

Here are taken into account the forward / leading ratios because it is reasonable that fundamentals produce effects especially on the expected rather than on the actual *value relevant* variables.[2] In particular, may seem interesting and quite different from previous studies (novelty) the intention to examine the association between P/E and its determinants in a world-basis perspective and in light of the recent globalized economic-financial crisis. In such a choice lies the question of the research.

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Consequently we wonder if 'hard', extraordinary times dominated by chaos and even irrationality are characterized or not by the significant association between P/Es and firms' fundamentals (precisely dividends-based variables, risk, growth, leverage, tax rates) we can expect in ordinary / normal times.

It is likewise known that the P/E ratio, as an indicator of how much value the market places on each currency unit of firms' earnings, reflects the investors' sentiments about the equity stocks. At the same time it may influence the investment decisions. As a pricing signal to investors, a P/E multiple considerably above or below norms (i.e. notionally normal values) means a warning of a market correction.

Market participants and agents take usually in great consideration firms' fundamentals (*in primis* dividend ratios); for this reason it is believed that, in principle, the relative equity prices reveal (to some extent) the information embedded in fundamentals. Nevertheless, some important anomalies are undoubtedly susceptible to distort the normal relationship between earnings prices and fundamentals. Thus, the need to observe and better understand the P/E ratio determinations in a scenario *under pressure*, even in new and highly uncertain situations (resulting from the global crisis), is the main reason behind our study, which we try to begin filling a gap in knowledge with.

That said, the rest of the article is organized as follows: Section 2 presents the literature-background concerning P/E (and E/P) multiple and the relating fundamental determinants; Section 3 assumes the hypotheses of the research (after deriving them from the Dividend Discounted Model *paradigm* on the basis of the SHV theoretical perspective), whereas Section 4 describes the econometric model (OLS and WLS) and the relating dataset used for the empirical analysis; Section 5 provides the test results coming from the cross-sectional regressions; Section 6 discusses them and concludes with a summary of the major findings. At the end, there are an appendix and the bibliographic references.

## 2. Background Literature

Perhaps the major reason for P/E's popularity is that it is simple to calculate and understand (hence it is easily handled by managers, accountants and analysts). Furthermore, such indicator is enough robust: financial theory indeed states it represents an alternative version of the robust shareholders' value (SHV) Dividend Discount Model (DDM).

In general, Shiller (1981) finds that stock prices are not stable and fluctuate excessively in relation to the news about fundamentals (as dividends) primarily due to market irrationality. Zhong, Darrat & Anderson (2003) detect a significant non-fundamental component in US equity prices, while Cochrane (1991) suggests funneling the efforts in the direction of a better rational model of fundamentals. Besides, Shiller (2000) explains residuals from fundamentals through a psychological and popular model of irrationality. Similarly to Basu (1977 and 1983) – whose studies laid the foundation for subsequent researches as Cook & Rozeff's (1984), Fama & French's (1992) and Ohlson's (1995) – Shiller finds that a high P/E ratio with earnings averaged over a decade predicts a low real rate of return on the S&P 500 index, whereas low P/E equities experience superior returns outperforming high P/E firms. About the need of market anomalies neutralization, Brav & Heaton (2002)

suggest that the financial models should consider the rational structural uncertainty, on one side, and the behavioral or investor irrationality, on the other side. Harney & Tower (2003) instead establish the predictive superiority of Tobin's Q over the P/E ratio.

Literature focused on the association or alignment between P/E and fundamental determinants can be resumed as follows.

Cross-sectional studies comprise, among others, Beaver & Morse (1978), Craig, Johnson & Joy (1987), Zarowin (1990), Cho (1994), Fairfield (1994), Allen & Cho (1999), Nikbakht & Polat (1998): earnings growth rate, volatility / risk and dividend payouts seem to explain well P/E variations across firms. Time series studies instead include, among others, Reilly, Griggs & Wong (1983), Kane, Marcus & Noh (1996), White (2000), Ramcharran (2002), Shamsuddin & Hiller (2004): they all investigate factors (like inflation, *g*, payouts, dividend yield, total returns, market volatility, long-term bond yield, GDP) which are able to determine P/E fluctuations in different periods.

More in particular, while examining price-earnings ratios over time, Beaver & Morse (1978) employ (a) the stock beta in order to measure equity risk and (b) the percentage change in earnings per share to value earnings growth: they find no significant relationship between P/E, risk and growth across the equity market. Much of the effect of the factors influencing P/E ratios diminishes over the long run (drastically by the third year). Craig, Johnson & Joy (1987) extend such a study and investigate the reverberation of the accounting method on P/E ratio. They suggest that stock valuation based on P/E should be related to adjustments for accounting methods differences. Zarowin (1990) provides a model derived by Litzenberger & Rao (1971); thus he uses an *ex-ante* forecast level of earnings and finds P/Es significantly associated with forecast long-term growth (but not with past growth or risk). The Author assumes that the market is able to forecast firms' short-term earnings growth as well as the long-term earnings growth rate. Leibowitz & Kogelman (1990), instead, introduce a new perspective (the "franchise factor") to try and explain the relationship between P/E ratio and growth. They point out a certain confusion about the interpretation of growth in the preceding literature. The mere concept of positive growth, when disassociated from incremental value (i.e. investments in exceptional and profitable opportunities), would not allow giving an explanation of a higher valuation. Alford (1992) shows that a notable portion of cross-sectional variation in P/E multiples is justified by the industry profile as surrogate for the component of risk and earnings growth. He finds that growth is not incrementally significant in determining P/E. On the contrary, Kothari (1992) analysis evaluates alternative specifications of P/Es regressions when prices lead earnings, in other words, when prices reflect information about future earnings not embedded in the past time series of earnings.[3]

Afterwards, Dontoh, Livnat & Todd (1993) examined the variables susceptible to affect the cross-sectional distributions of earnings/price ratios (E/P, the reciprocal of P/E) both within and across countries. A theoretical model is utilized to show that the following variables can influence the variation in E/Ps: (i) interest rates, (ii) dividend yield, (iii) growth (abnormal earnings), and (iv) risk estimation (the uncertainty about abnormal earnings).

Cho (1994) improves the previous cross-sectional researches by both *ex-ante* and *ex-post* measures of risk and growth. Specifically the *ex-ante* risk, growth and payouts appear the most explanatory factors for P/E (as regards *ex-post* data only the leverage proxy seems significantly related to the P/E ratio). About portfolio diversification policies, Dreman (1994) then warns that investors should exercise caution in adopting the low P/E strategy.

Kane, Marcus & Noh (1996) find the market volatility significant while analyzing the P/E of S&P 500 index through the ARCH model. Allen & Cho (1999) suggest to utilize both *ex-post* and *ex-ante* measures of risk and growth, although the forecast growth (rather than risk) appeared a strong predictor of P/E (on the contrary, historical growth and risk did not seem good predictors). Cheng & McNamara (2000) analyze then the valuation accuracy of both the Price-Earnings and the Price-Book multiple: within the P/E and P/BV benchmark valuation methods the best definition of the comparable firms appears the one based on the industry membership combined with the return on equity. Chowdhry & Titman (2001) investigate why real P/E ratios do vary across countries. More particularly Shamsuddin & Hillier (2004) scrutinize factors fundamental to the setting of the P/E multiple for the Australian stock market and suggest that substantial deviation from historical average may be caused by deviations of the underlying fundamentals. Many other studies instead touched distinctively US and Japanese markets: see among others Glen & Herring (1994), White (2000) & Park (2000).

An interesting paper by Ramcharran (2002) offers an empirical analysis of the determinants of the P/E ratio in emerging markets and evaluates the importance of economic growth and credit risk there. The findings for emerging markets are supportive of growth (earnings potential) as a basic determinant of cross-country P/Es' variation. After their stimulating study about the Long-Term P/E Ratio, Anderson & Brooks (2006) instead suggest that a P/E calculated from multiple years of earnings is a better predictor of returns than the traditional one-year P/E. Correctly, an eight-year average is twice effective, while earnings from two or three years ago seem particularly poor predictors. Besides, Bhargava & Malhotra (2006) investigate whether an high P/E indicates (a) high or low earnings' growth or (b) higher or lower future stock prices; they find that with high P/E ratios subsequent prices do rise but subsequent yields decline.

Hamberg & Novak (2010), in their interesting recent study of the E/P ratio strategies and related biases, find that transitory earnings and accounting conservatism introduce noise into E/P so that adjustments for accounting characteristics seem to make the identification E/P-based more effective.

In this regard, it is hardly necessary to observe that the (reciprocal) E/P[4] is a ratio widely used to judge how expensive the stock of a corporation is, relative to its ability to earn profits. Anyway, by employing Euro area aggregate stock market data, Taboga (2011) shows how judgments based on such a ratio may be myopic since movements are often driven by cyclical oscillations in earnings not affecting the long-run profitability of corporations. The Author proposes a correction that decreases sensitivity to cyclical fluctuations and finds periods when such an adjustment is definitely consequential (for example, before the 2008-2009 crisis the unadjusted E/P ratio made stock prices look relatively cheap).[5]

That said, for a more comprehensive discussion on the determinants of the P/E (and E/P) ratios, see also Jones (2000), Damodaran (2002) and Zanda, Lacchini & Onesti (2013).[6]

At this point, in order to build and develop a P/E multiple fundamental-based regression model accordingly with the scope of our research, we have firstly to keep in mind the relevant theoretical power of the financial quantitative dividend discount model.

Let us start from the classical Gordon (1959) growth model of firms:

$$P_{t-1} = D_t / (i - g) \quad [1]$$

Where *P* is the price level of equity, *D* are dividends, *I* the cost of equity and *g* the growth rate of a company.

After dividing the expression by the last 12 months' earnings, we get the formula for the trailing P/E multiple:

$$P_{t-1} / E_{t-1} = D_{t-1} (1 + g) / [E_{t-1} (i - g)] = \\ = (1 - r) (1 + g) / (i - g) \quad [2]$$

Where *r* equals to earnings' retention rate and *1– r* is the dividend payout ratio (*p*).

The leading or forward P/E multiple is obtained by dividing both sides of the equation [1] by the forecast value of earnings:

$$P_{t-1} / E_t = D_t / [E_t(i - g)] = \\ = (1 - r) / (i - g) = p / (i - g) \quad [3]$$

Consequent implications are:

- P/E is positively related to dividend payout, all else equal;
- P/E is positively related to dividend growth rate, *ceteris paribus*;
- P/E is inversely related to required return (or cost of equity), all else equal.

Honestly the condition *all else equal* (i.e. *ceteris paribus*) is conventional and useful although not ever realistic: in fact the above said explanatory variables are mutually interrelated.

If a sustainable growth rate (*g*) is calculated by multiplying the return on equity (roe) by the retention rate (which is the complement to the payout rate, i.e. the fraction of the net income not paid out as dividends), it allows writing:

$$P_{t-1} / E_t = D_t / [E_t(i - g)] = \\ = p / [i - roe^* (1 - p)] \quad [4]$$

Thus, the impact of *p* (payout ratio) is positive only if the effect in the numerator (when the corresponding flows increase) is stronger than the one in the denominator (by reducing *g*). It is superfluous to remind that the cost of equity (*i*) is generally

calculated through the CAPM by adding the risk free rate of interest to a risk premium based on *beta factor*. Well, if we get *g* (growth rate) starting from roe, in coherence with the Modigliani & Miller (1958; 1963) propositions, we can argue that the researched P/E multiple depends also on return on investment, leverage ratio and tax rate.[7]

Hence the specification of the following hypotheses of our empirical study (see next paragraph), whose starting point is the absence in the extant literature of the specific research topic about the effects exerted by firms' fundamentals on the most important valuation multiple, the P/E ratio, when determined on a worldwide basis immediately after a very peculiar and relevant event case: the 2008/2009 global financial crisis. Moreover, the above said absence (which is not a limitation *stricto sensu*) is justified by the fact that the previous studies ignored the imminence and consequences of such an extraordinary crisis. Therefore, it is interesting to investigate if and to what extent some distortions in P/E determinations may emerge in a new, uncertain contest.

## 3. Hypotheses

In light of the above described background literature (which is essentially founded on the DDM under the SHV perspective) and in accordance with the common sense, we may in general expect, first and foremost, a positive association between P/Es and dividends paid out. More in particular, we are enabled to assume and test the following rational hypotheses:

***HP1a****: Firms with higher payouts (i.e. lower reinvestment needs) are more likely to have higher P/E ratios than companies which assign lower dividends to their shareholders.*

***HP1b****: Firms with higher dividend yields are more likely to register lower P/E ratios than companies with lower dividends to price.*

***HP2****: Higher risk firms are more likely to have lower P/E ratios than lower risk ones.*

***HP3****: Higher growth firms are more likely to present higher P/E ratios than lower growth ones.*[8]

***HP4****: Firms with higher financial leverage ratios should present higher P/E ratios than firms less leveraged* (that is true to the extent that the capital return is higher than the cost of debt, due to the leverage-effect on the growth rate [4]). *Nevertheless, when the return on capital is lower than the cost of debt and the financial leverage influences highly the measure of risk as it happens in times of crisis, firms more leveraged should have lower P/Es.*

***HP5****: Taxation produces a bidirectional effect on P/E.* On one hand, the tax rate level (since it reduces firm's earnings) should be all else equal positively associated to the specific P/E. On the other hand, higher taxes imply lower (real or potential) dividends that means, also in relation to the adjusted by taxation MM leverage-effect, lower P/E. *In difficult periods* (as in times of crisis, when firms usually wish tax reliefs that stimulate optimism too), *because of the lower level of taxable earnings*, *we may*

*expect that* the second effect should prevail, so that *the association with P/E should be negative*.

Overall, our purpose is to test the above said rational hypotheses for the major, quoted firms, highlighting the earliest effects of the recent global crisis. Therefore, the null hypothesis is the following.

***HP0*** *(joint null hypothesis): Essentially due to biases, chaos and irrationality caused by the global crisis, no significant association between the forthcoming P/Es of quoted firms and the mentioned fundamentals-based ratios and rates (i.e. dividends-based variables, risk, leverage ratios and tax rates) should be expected.*

## 4. Method and Dataset

Our empirical study of the relationship between forward P/E and fundamental determinants adopts the common ordinary least squares method (OLS). The unknown parameters of a linear regression model here are estimated minimizing the sum of the squared vertical distances between the observed responses in P/Es dataset (*infra*) and the responses predicted by the multivariate approximations. OLS estimators are consistent when the regressors are exogenous and multicollinearity is absent, and unbiased if errors are homoskedastic.

We refer to n. 34,787 firms from: United States; Australia, New Zealand and Canada; Europe (UE, UK, Switzerland and Scandinavia); Japan; Emerging Markets (Asia, Latin America, Eastern Europe, Mid East and Africa). In particular, here are considered all the US quoted firms and the major listed enterprises of the rest of the World (with market capitalization greater than 5 million $), which constitute a quite large and value relevant sample. Their annual data relative to year 2010 (sources: Value Line, Capital IQ, Bloomberg; updated January 2011) are aggregated in consideration of the (n. 95) industry categories elaborated by Damodaran.[9]

We undertake three main models (A, B, and C) for the cross-sectional forthcoming P/Es regression, paying special attention to the dividend-based variables. In particular, the Model A intends to detect the association between forward P/Es and payout ratios (see HP1a), whereas Model B tries to verify the association between forward P/Es and dividend yields (see HP1b); at last, Model C attempts to examine together payout ratios and dividend yields in order to catch their simultaneous influence on the regressed P/Es.

Theoretical SHV-DDM (as *supra*) explains why and how the payout ratio is in general expected to impact on P/Es. Since *earnings* equal to *dividends plus retentions*, it is clear that the dividend yield (or dividend to price) ratios, in the main, are expected to be inversely related to P/Es (and thus positively to the earnings yields). More precisely, both theory and historical evidences appear to demonstrate such relationships.[10]
The above said models take also into account other control variables related to the P/E ratio as emerging from our hypotheses (*supra*): risk, roe/growth, leverage, taxation.
Models A, B and C are expounded below.

*Model A*

The forward P/E is a function of: Dividend_Payout (*p*); Beta; Roe; Market_D/E (i.e. leverage); Tax_rate. The equation is:

$$FP/E = const. + b_1\ Dividend\_Payout + b_2\ Beta + b_3\ Roe + b_4\ Leverage + b_5\ Tax\ rate + \varepsilon_i \quad [A]$$

*Model B*

The forward P/E is a function of: Dividend_Yield; Current P/E; Beta; Roe; Market_D/E; Tax_rate. In this case *p* has been proxied by Dividend_Yield x Current P/E. Equation:

$$FP/E = const. + b_{1a}\ Dividend\_Yield + b_{1b}\ CP/E + b_2\ Beta + b_3\ Roe + b_4\ Leverage + b_5\ Tax\ rate + \varepsilon_i \quad [B]$$

*Model C*

The forward P/E is a function of: Dividend_Payout; Dividend_Yield; Roe; Market_D/E; Tax_rate. This time, price to earnings ratio is obtained dividing *p* by the dividend yield: indeed, P/E = (P/E) x (D/D) = (D/E) x (P/D) = (D/E) / (D/P). Since the latter term of the last member includes P, here the dividend yield indirectly captures the measure of the cost of equity *i* (and then of risk).[11]The equation is:

$$FP/E = const. + b_1\ Dividend\_Payout + b_2\ Dividend\_Yield + b_3\ Roe + b_4\ Leverage + b_5\ Tax\ rate + \varepsilon_i \quad [C]$$

The main statistics below (Table 1) describe the foremost characteristics of our variables.

**Table 1. Descriptive statistics**

| *Variable* | *Mean* | *Median* | *Min* | *Max* | *Std. Dev.* | *Coeff. of Variat.* | *Kurtosis* |
|---|---|---|---|---|---|---|---|
| Forward_P/E | 23,4188 | 20,4538 | 8,13115 | 88,0628 | 12,1114 | 0,517167 | 11,1069 |
| Payout | 0,303461 | 0,290689 | 0,0576123 | 0,632335 | 0,00840106 | 0,520357 | 1,80166 |
| Beta | 0,865194 | 0,722149 | 0,407721 | 7,68519 | 45,5470 | 0,670460 | 7,88677 |
| Div_Yield | 0,0161448 | 0,0150557 | 0,00122694 | 0,0450377 | 0,777820 | 0,899012 | 61,1875 |
| Current_P/E | 67,9340 | 53,8348 | 23,3205 | 306,022 | 0,128124 | 0,422210 | -0,361301 |
| Growth rate | 0,0985905 | 0,0905941 | 0,0206654 | 0,324652 | 0,0504653 | 0,511867 | 3,54922 |
| Market_D/E | 1,19528 | 0,326281 | 0,0400696 | 58,0117 | 5,98997 | 5,01133 | 84,0513 |
| Tax_rate | 0,162773 | 0,167115 | 0,0231525 | 0,276476 | 0,0519660 | 0,319254 | 0,539119 |

Whereupon, the following matrix (Table 2) identifies the (Bravais-Pearson) correlation coefficients. In order to prevent any collinearity problem within our econometric model, the growth rate is substituted by roe (whereas the retention rate is reflected by the complementary payout ratio).[12]

**Table 2. Correlation coefficients**

| *Forw_P/E* | *Div_Yield* | *Curr_P/E* | *Beta* | *Market_D/E* | *Tax_rate* | *Payout* | *Roe* | |
|---|---|---|---|---|---|---|---|---|
| 1,0000 | -0,3293 | 0,2895 | 0,0329 | 0,1893 | -0,3565 | -0,1887 | 0,0673 | *Forw_P/E* |
| | 1,0000 | -0,2978 | -0,1053 | 0,0687 | 0,2141 | 0,7997 | 0,1026 | *Div_Yield* |
| | | 1,0000 | 0,0241 | -0,0136 | -0,3393 | -0,2318 | -0,0584 | *Curr_P/E* |
| | | | 1,0000 | -0,0482 | -0,0949 | -0,0683 | -0,0022 | *Beta* |
| | | | | 1,0000 | 0,0235 | -0,0533 | 0,7584 | *Market_D/E* |
| | | | | | 1,0000 | 0,1308 | 0,0936 | *Tax_r* |
| | | | | | | 1,0000 | -0,1733 | *Payout* |
| | | | | | | | 1,0000 | *Roe* |

*[5% critical value (two-tailed) = 0,2006]*

From above we learn that payouts and dividend yields are positively correlated (both evidently led by the variation of the level of dividends): for this reason it would be necessary to detect possible multicollinearity in the context of the projected P/Es regression.[13] Also return on equity and financial leverage are positively correlated: that seems to reveal a MM leverage effect on equity profitability. In the other cases no considerable correlation between variables can be observed.

## 5. The Findings

*Model A*

This subsection summarizes the results of the Model A (see Table 3) and the inherent specific information (for statistics and tests see Table 4 and the relative notes). The regression is further presented in the form of equation [5].

**Table 3. Multiple linear regression OLS (A). Dependent variable: Forward_P/E**

| | *Coefficient* | *Std. Error* | *t-statistic* | *p-value* | |
|---|---|---|---|---|---|
| *Const* | 47,8355 | 8,20062 | 5,8332 | <0,00001 | *** |
| *Dividend_Payout* | -18,4657 | 8,61813 | -2,1427 | 0,03490 | ** |
| *Beta* | -0,0330317 | 0,491396 | -0,0672 | 0,94656 | |
| *Roe* | -44,6199 | 26,2629 | -1,6990 | 0,09286 | * |
| *Market_D/E* | -2,24351 | 0,616243 | -3,6406 | 0,00046 | *** |
| *Tax_rate* | -70,6981 | 23,2311 | -3,0433 | 0,00309 | *** |

Robust standard errors are corrected for heteroskedasticity *à la* White (for details on the stimators see: White 1980; MacKinnon & White 1985; Davidson & MacKinnon 2004).

**Table 4. Regression statistics (Model A)**

| | | | |
|---|---|---|---|
| *Var. depend. Mean* | 23,14838 | *Var. depend. Std Dev.* | 11,88455 |
| *Sum Squared Errors* | 10203,51 | *Standard Error* | 10,76796 |
| *R-squared* | 0,223214 | *Adjusted R-squared* | 0,179078 |
| *F(5, 88)* | 4,076014 | *p-value(F)* | 0,002246 |
| *Log Likelihood* | -353,6783 | *Akaike Criterion* | 719,3566 |
| *Schwarz Criterion* | 734,6163 | *Hannan-Quinn* | 725,5204 |

*** level of significance 1%
** level of significance 5%
* level of significance 10%

The necessary analysis for heteroskedasticity (a) and multicollinearity (b) relative to the Model A is expounded below.

*(a) White's test for heteroskedasticity*:

- Null hypothesis: homoskedasticity (absence of heteroskedasticity)
- Statistic test: LM = 26,1978
- *p-value* = P(*Chi-square*(20) > 26,1978) = 0,159378

*(b) Multicollinearity detection test (VIF: Variance Inflation Factor)*:[14]

- Minimum VIF: 1.0. Collinearity problem: VIF > 10; VIFs:
- Dividend_Payout1,074
- Beta 1,017
- Roe 1,150
- Market_D/E 1,094
- Tax_rate 1,056

Thus the equation is:

$$FP/E = 47{,}8355(***) - 18{,}4657\ Dividend\_Payout(**) - 0{,}0330317\ Beta - 44{,}6199\ Roe(*) - 2{,}24351\ Leverage(***) - 70{,}6981\ Tax\ rate(***) + \varepsilon_i \quad [5]$$

It is important to point out that the same equation has also been tested by considering a *dummy* variable with values 1 in the case of membership to finance / banking / assurance sector, and 0 in the case of other industry categories. The presence of such a qualitative independent variable demonstrated a negative association with forward P/Es (anyhow denoting a very low p-value) and, more in general, no relevant impact on the Model A: accordingly, estimates do not appear to be conditioned as regards R-square, F-test, etc. by the fact that firms belong or not to finance / banking / assurance sector (which are in many ways more critical at the first stages of a financial crisis) rather than to industry sector.

*Model B*

The main results of the Model B (Table 5) and the inherent specific information (statistics and tests: Table 6 and relative notes) here follow. The regression is further presented in the form of equation [6].

**Table 5. Multiple linear regression OLS (B). Dependent variable: Forward_P/E**

| | *Coefficient* | *Std. Error* | *t-statistic* | *p-value* | |
|---|---|---|---|---|---|
| *Const* | 37,7136 | 8,38874 | 4,4957 | 0,00002 | *** |
| *Dividend_Yield* | -356,009 | 143,234 | -2,4855 | 0,01483 | ** |
| *Current_PE* | 0,0336763 | 0,0322178 | 1,0453 | 0,29876 | |
| *Beta* | -0,11555 | 0,41153 | -0,2808 | 0,77954 | |
| *Roe* | -10,5785 | 18,5276 | -0,5710 | 0,56948 | |
| *Market_D/E* | 0,568573 | 0,261638 | 2,1731 | 0,03246 | ** |
| *Tax_rate* | -60,5091 | 24,2339 | -2,4969 | 0,01439 | ** |

As said, the OLS regression utilizes heteroskedasticity-consistent standard error estimates.

**Table 6. Regression statistics (Model B)**

| | | | |
|---|---|---|---|
| *Var. depend. Mean* | 23,41879 | *Var. depend. Std Dev.* | 12,11142 |
| *Sum Squared Errors* | 10237,71 | *Standard Error* | 10,78599 |
| *R-squared* | 0,257520 | *Adjusted R-squared* | 0,206897 |
| *F(6, 88)* | 8,771804 | *p-value(F)* | 1,72e-07 |
| *Log Likelihood* | -357,0971 | *Akaike Criterion* | 728,1942 |
| *Schwarz Criterion* | 746,0713 | *Hannan-Quinn* | 735,4179 |

*** level of significance 1%
** level of significance 5%
* level of significance 10%

The necessary analysis for heteroskedasticity (a) and multicollinearity (b) for the Model B is summarized as follows.

*(a) White's test for heteroskedasticity:*

- Statistic test: LM = 31,2898
- *p-value* = P(*Chi-square*(27) > 31,2898) = 0,259406

*(b) Multicollinearity detection test (VIF: Variance Inflation Factor):*

- Dividend_Yield 1,132
- Current_PE 1,204
- Beta 1,024
- Roe 2,406
- Market_D/E 2,383
- Tax_rate 1,167

The resulting equation is:

$$FP/E = 37{,}7136(***) - 356{,}009\ Dividend\_Yield(**) + 0{,}0336763\ CP/E - 0{,}11555\ Beta - 10{,}5785\ Roe + 0{,}568573\ Leverage(**) - 60{,}5091\ Tax\ rate(**) + \varepsilon_i \quad [6]$$

Again, our equation has been also set introducing a *dummy* variable (1: finance / banking / assurance sector; and 0: other industry cases). The presence of such a dummy demonstrates a negative association (actually biased by a very poor p-value) with forward P/Es and, more in general, no relevant impact on the model in terms of R-square, F-test, etc.

*Model C*

The main results of the Model C (Table 7) and the inherent specific information (statistics and tests: Table 8 and relative notes) can be found below. Subsequently, the regression will be presented in the equation form [7].

**Table 7. Multiple linear regression OLS (C). Dependent variable: Forward_P/E**

| | *Coefficient* | *Std. Error* | *t-statistic* | *p-value* | |
|---|---|---|---|---|---|
| *Const* | 43,7415 | 8,02675 | 5,4495 | <0,00001 | *** |
| *Dividend_Payout* | 9,87327 | 12,8964 | 0,7656 | 0,44597 | |
| *Dividend_Yield* | -511,898 | 182,821 | -2,8000 | 0,00628 | *** |
| *Roe* | -26,8884 | 24,5925 | -1,0934 | 0,27722 | |
| *Market_D/E* | -1,73835 | 0,603127 | -2,8822 | 0,00496 | *** |
| *Tax_rate* | -65,0011 | 23,0298 | -2,8225 | 0,00589 | *** |

As before, the OLS regression employs heteroskedasticity-consistent standard error estimates.

**Table 8. Regression statistics (Model C)**

| | | | |
|---|---|---|---|
| *Var. depend. Mean* | 23,14838 | *Var. depend. Std Dev.* | 11,88455 |
| *Sum Squared Errors* | 9702,485 | *Standard Error* | 10,50026 |
| *R-squared* | 0,261357 | *Adjusted R-squared* | 0,219388 |
| *F(5, 88)* | 4,957813 | *p-value(F)* | 0,000479 |
| *Log Likelihood* | -351,3118 | *Akaike Criterion* | 714,6236 |
| *Schwarz Criterion* | 729,8834 | *Hannan-Quinn* | 720,7875 |

*** level of significance 1%
** level of significance 5%
* level of significance 10%

Follows the necessary analysis for heteroskedasticity (a) and multicollinearity (b) for the Model C.

*(a) White's test for heteroskedasticity:*

- Statistic test: LM = 23,7859
- *p-value* = P(*Chi-square*(20) > 23,7859) = 0,251871

*(b) Multicollinearity detection test (VIF: Variance Inflation Factor):*

- Dividend_Payout 3,516
- Dividend_Yield 3,454
- Roe 1,369
- Market_D/E 1,147
- Tax_rate 1,064

Thus the equation is:

$$FP/E = 43{,}7415(***) + 9{,}87327\ Payout - 511{,}898\ Dividend\_Yield(***) - 26{,}8884\ Roe + 1{,}73835\ Leverage(***) - 65{,}0011\ Tax\ rate(***) + \varepsilon_i \quad [7]$$

Once again, the equation has been re-attempted by introducing a *dummy* variable (finance / banking / assurance sector *vs.* other industry cases). The dummy still proves the existence of a negative association (in point of fact affected by very low p-value) with forward P/Es and, more in general, no relevant impact on the model in terms of R-square, F-test, etc.

In order to minimize the heteroskedasticity effects another regression is attempted below, this time through WLS assumptions (C - variant).

*Model C (variant)*

This subsection summarizes the main results of the Model C - variant (Table 9) and the inherent specific information (statistics and tests: Tables 10-10bis and relative notes). At last, the regression is presented in the equation form [8].

**Table 9. Weighted least squares (WLS) method. Dependent variable: Forward_P/E**

| | *Coefficient* | *Std. Error* | *t-statistic* | *p-value* | |
|---|---|---|---|---|---|
| *Const* | 35,7204 | 3,7507 | 9,5237 | <0,00001 | *** |
| *Dividend_Yield* | -507,7 | 146,343 | -3,4692 | 0,00081 | *** |
| *Dividend_Payout* | 14,64 | 9,19962 | 1,5914 | 0,11511 | |
| *Roe* | -9,69353 | 13,88 | -0,6984 | 0,48678 | |
| *Market_D/E* | -1,02228 | 0,354713 | -2,8820 | 0,00496 | *** |
| *Tax_rate* | -49,7018 | 9,13095 | -5,4432 | <0,00001 | *** |

This regression makes use of heteroskedasticity(HSK)-consistent standard error estimates.[15]

**Table 10. Regression statistics upon weighted values (Model C – variant)**

| | | | |
|---|---|---|---|
| *Sum Squared Errors* | *271,4356* | *Standard Error* | *1,756273* |
| *R-squared* | *0,396879* | *Adjusted R-squared* | *0,362611* |
| *F(5, 88)* | *11,58153* | *p-value(F)* | *1,31e-08* |
| *Log Likelihood* | *-183,2204* | *Akaike Criterion* | *378,4409* |
| *Schwarz Criterion* | *393,7007* | *Hannan-Quinn* | *384,6047* |

**Table 10b is. Regression statistics upon original values (Model C – variant)**

| | | | |
|---|---|---|---|
| *Var. depend. Mean* | *23,14838* | *Var. depend. Std Dev.* | *11,88455* |
| *Sum Squared Errors* | *10064,63* | *Standard Error* | *10,69443* |

*** level of significance 1%
** level of significance 5%
* level of significance 10%

In this case it is superfluous to test heteroskedasticity, because WLS is *ex-ante* adjusted for that purpose; whereas the multicollinearity detection test by means of VIF gives results similar to the previous (OLS).

Under the WLS assumptions, the equation would be the following:[16]

$$FP/E = 35{,}7204(***) - 507{,}7\ Dividend\_Yield(***) + 14{,}64\ Payout - 9{,}69353\ Roe + 1{,}02228\ Leverage(***) - 49{,}7018\ Tax\ rate(***) + \varepsilon_i$$

The next section will finally interpret the results coming from the above models. The findings are deputed to answer to our research question and contribute, as far as possible, to the body of knowledge by beginning to cover the gap around the P/E determinants studies relative to an extraordinary pervasive situation like the recent GFC. Such fundamental determinants are, as seen above, the dividend ratios and the main financial control indicators (risk, roe/growth, leverage, tax rate).

## 6. Summary and Conclusions

The present article has tested some research hypotheses (*supra*: HP1-HP5) concerning the effect of the underlying determinants of the forward price to earnings ratio, through some alternative multiple linear regression models (Model A, B, C). In general terms, the scope of the paper has been to register recent empirical evidences from a worldwide cross-sectional multivariate analysis, based on the major / listed firms from US, Australia / New Zealand / Canada, Europe, Japan and Emerging Markets. The investigated year (2010) is very close to the explosion of the recent 2008/2009 global financial crisis (GFC). Hence, it may appear interesting and noteworthy to scrutinize in such a perspective some important explanatory (*value relevant*) variables.

After our analysis, the joint null hypothesis (HP0: no association between P/E and fundamentals in times of crisis) appears rejectable.

In particular, the Model A assumes the payout ratio as the foremost value component in coherence with the classical SHV-DDM theoretical framework. Nonetheless we found (surprisingly) a non-intuitive negative association between such component and the prospective P/E. Probably this statistically significant (p-value below 5%) relation could be explained by market anomalies / irrationality and by a possible consideration of earnings' retention as a conservative response strategy of firms to the recent GFC (so that less dividends paid out would defensively create wealth). Other findings are the following: there is no significant association with beta; there is a statistically significant (below 10%) negative association with return on equity.[17] About control variables: there are negative associations between forward P/E and both financial leverage and taxation (both statistically very significant: below 1%). As regards the goodness of fit of the model, R-squared is 22%, while adjusted R-squared amounts to 18%; the F-statistic for the regression significance (4.076014; p-value: 0.002246) is acceptable. The White's test for heteroskedasticity is barely succeeded, whereas there is absolutely no multicollinearity (VIFs are always very close to 1). Therefore, the overall results of the Model A are not fully satisfying.

The Model B instead assumes the dividend yield as the foremost element in coherence with a de-composed DDM. The expected negative association between the dividend yield and the forward P/E is confirmed. The relation is statistically significant (below 5%), while there is no significant association between (a) forward P/E and (b) current P/E, beta and roe (p-value all over 10%). Furthermore, as concerns our control variables, we have a positive association with financial leverage and a negative association with firms' taxation, both statistically significant (below 5%). As regards the goodness of fit of the model, R-squared amounts to 26%, while adjusted R-squared reduces to 21% (better than before); F-statistic for the significance of the regression (8.771804; p-value: 1.72e-07) appears good. The White's test for heteroskedasticity is succeeded and no multicollinearity is detected. Overall, the results of the Model B appear slightly satisfying.

The Model C at the same time assumes both the payout ratio and the dividend yield as crucial combined value components. The expected negative association between the dividend yield and the forward P/E is confirmed and statistically significant (below 5%), whereas appears no significant P/E association by considering the payout ratio.

Other findings are: there is no significant association between P/E and roe; there is a statistically very significant (below 1%) negative association with both financial leverage and firms' taxation. The coefficient of determination is 26%, the adjusted R-squared equals to 22% (the goodness of fit of the model is better), whereas the overall significance F-statistic (4.957813; p-value: 0.000479) is good. The White's test for heteroskedasticity is succeeded and, again, no multicollinearity problem emerges. In the aggregate, the results coming from the Model C appear therefore acceptable.

In order to minimize heteroskedasticity (rarely null in cross-sectional analysis, where homoskedasticity is unrealistic), after the OLS technique we attempted an empowered WLS-HSK variant of the Model C. All the above associations detected by the Model C are validated, this time with lower p-values (then with higher statistical significance of the single independent variables, always below 1%). In this case there is no need to test heteroskedasticity and multicollinearity. R-squared is here 40%, while adjusted R-squared amounts to 36% (the goodness of fit is much better than before); overall significance F-statistic (11.58153; p-value: 1.31e-08) is good. At first sight, due to such statistical indicators, the findings seem much more satisfactory now. Nevertheless, the powerful WLS-HSK variant is founded on assumptions about errors' variance estimates that are not actually verified (thus might be false). This fact definitely implies that the previous, more plausible Model C should be prudentially preferred.

Therefore, the results coming from the Model C may explain our research question better, and more reasonably, than the other models.

In sum, our findings appear supportive of the dividend yield (HP1b) as the prevailing determinant of the forthcoming P/E (the association between them is attested negative). On the contrary, the payout ratio hypothesis (HP1a) cannot be confirmed. Besides, we do not observe on stable basis the significant P/E relations with uncertainty (HP2) and growth indicators (HP3) that were expected (conjectured respectively negative and positive). The association with financial leverage (HP4) appears lightly negative (probably due to the weight of the return on debt and the implications of a certain level of debt in terms of profits' volatility) while the relationship with taxation (HP5) is assuredly negative (as expected). These two control variables (financial leverage and corporate taxation) are statistically relevant.

The adjusted R-squared of the selected model seems enough acceptable for a cross-sectional analysis context, whereas the overall significance of the statistical outcome appears good.

However, we believe that further components (even qualitative) could be *de facto* able to play an important explanatory role for the P/E determinations. At the moment such components remain only implicit in the errors of our model (e.g., generation mechanism of future earnings expectations; irrationality logic and financial behavior; accounting methods choices etc.).[18] Within an improved regression model it would be worthwhile and valuable (for further researches) to try and explicate those or other qualitative components the lack of which, in point of fact, limits our analysis.

Another limitation of the present research lies in the consideration that Emerging Markets data comprise economic-geographical areas (e.g. China) which responded

quite differently from others as USA or Europe to the impact of the global financial crisis (it could be helpful and useful to make a separate analysis in such cases). Nonetheless, our purpose was to capture at a glance some general trends relative to the P/E determinants at the prospect of both the world-wide crisis and the actual globalization processes.

In conclusion, this article dealt with an issue of likely wide interest to readers concerned with the functioning of capital markets, notably the impact of financial crisis on earnings' pricing rationality. Our findings relative to 2010, more likely due to the biases created by the crisis context, do not fully confirm all the theoretical conjectures about the traditional fundamental determinants of P/E expounded by the financial theory. Above all, we underline that the usual, rational, positive association between P/Es and payouts cannot be confirmed. Other indicators and control variables (risk, roe/growth, leverage and tax rate) complete the empirical analysis: while our assumptions about risk and roe/growth (which are recognized pillars of the value creation strategy of companies) cannot be confirmed in light of the crisis aftermath, the results relating to leverage and taxation appear more comforting (conjectures appear susceptible to be confirmed).

Ultimately, our exploratory research tried to ascertain the extent of the first and leading effects of the recent global crisis on earnings' pricing models. Certainly would be interesting a future comparative global study of the fundamental determinants of P/Es relative to times free of the crisis *specter*.

From a methodological viewpoint, any high levels of data's heterogeneity and endogeneity may suggest (for further research) developing either a robust system-GMM (generalized method of moments) or a non-linear econometric model.

## Endnotes

[1] Nicholson (1960) stated that "The purchaser of common stocks may logically seek the greater productivity represented by stocks with low rather than high price-earnings ratios.".

[2] When the expected earnings per share are considered, the ratio is called *Forward*, *Leading* or *Prospective* P/E.

[3] Since prices lead earnings, the specification which assumes the earnings-level-deflated-by-price variable in a price-earnings regression results 'better', in terms of bias in the estimated earnings response coefficient and explanatory power, than the specification with earnings-change-deflated-by-price and earnings-deflated-by-lagged-earnings variables.

[4] It is superfluous to note that E/P is the ratio between current earnings per share and the share price.

[5] Indeed earnings were inflated by a temporary cyclical boost.

[6] About the implications of earnings management and goodwill accounting on dividend policy, see Onesti & Romano (2012).

[7] In fact, equity return = [capital invested return + (capital invested return – debt return) x financial leverage] x (1 – tax rate).

[8] Roe and retention rate explain together the sustainable growth rate.

[9] Advertising; Aerospace/Defense; Air Transport; Apparel; Auto & Truck; Auto Parts; Bank; Banks (Regional); Beverage; Beverage (Alcoholic); Biotechnology; Broadcasting; Brokerage & Investment Banking; Building Materials; Business & Consumer Services; Cable TV; Chemical (Basic); Chemical (Diversified); Chemical (Specialty); Coal & Related Energy; Computer Services; Computer Software; Computers/Peripherals; Construction; Diversified; Educational Services; Electrical Equipment; Electronics; Electronics (Consumer & Office); Engineering; Entertainment; Environmental & Waste

Services; Farming/Agriculture; Financial Svcs.; Financial Svcs. (Non-bank & Insurance); Food Processing; Food Wholesalers; Furn/Home Furnishings; Healthcare Services; Healthcare Information and Technology; Healthcare Products & Services; Healthcare Services; Heavy Construction; Homebuilding; Hotel/Gaming; Household Products; Information Services; Insurance (General); Insurance (Life); Insurance (Prop/Cas.); Internet software and services; Investment Co.; Machinery; Metals & Mining; Office Equipment & Services; Oil/Gas (Integrated); Oil/Gas (Production and Exploration); Oil/Gas Distribution; Oilfield Svcs/Equip.; Packaging & Container; Paper/Forest Products; Pharma & Drugs; Power; Precious Metals; Publishing & Newspapers; R.E.I.T.; Railroad; Real Estate; Real Estate (Development); Real Estate (Operations & Services); Recreation; Reinsurance; Restaurant; Retail (Automotive); Retail (Building Supply); Retail (Distributors); Retail (General); Retail (Grocery and Food); Retail (Internet); Retail (Special Lines); Rubber& Tires; Semiconductor; Semiconductor Equip.; Shipbuilding & Marine; Shoe; Steel; Telecom (Wireless); Telecom. Equipment; Telecom. Services; Thrift; Tobacco; Transportation; Trucking; Utility (General); Utility (Water). For more details see the institutional web site: *http://pages.stern.nyu.edu/~adamodar/*.

[10] Some graphical representations inherent to the S&P 500 index dynamics of P/E (re-calculated *à la* Shiller), payout ratios and dividend yields (from 1880 to 2010) are offered in the appendix. It is superfluous to notice that the actual crisis started and propagated from the US market to the other markets.

[11] Roe (as a proxy of growth rate, gross of retention factor) is tested explicitly. See *infra*.

[12] Stable *g* is equal to *roe x (1 – p)*. Therefore, roe's descriptive statistics are the following: *Mean* = 0.14796; *Median* = 0.12926; *Min* = 0.039069; *Max* = 0.93341; *Std. Dev.* = 0.10180; *Coeff. of Variat.* = 0.68803; *Kurtosis* = 35.916.

[13] The issue of multicollinearity arises when two or more independent variables denote a strong linear relationship.

[14] $VIF(j) = 1/(1 - R(j)^2)$, where R(j) is the multiple correlation coefficient between the j variable and the other independent variables.

[15] The HSK-WLS determines an auxiliary regression in order to generate an estimate of the errors variance: logarithm of sum squared residuals from the preceding OLS regression is regressed on original regressors and on their squares.

[16] The stronger HSK-WLS equation has been also retried with a dummy variable (finance / banking / assurance sector; and other industry cases). That dummy demonstrates a non statistical association (due to its very low p-value) with forward P/Es and, more in general, no relevant bias on the model C *variant*, except for finally determining a positive association with payout (17.4965; p-value 0.0641). Overall, the impact in terms of variation of R-square, F, etc., is very modest.

[17] As said before, roe is utilized as a *gross* proxy rate of growth.

[18] In that sense Beaver and Morse (1978) suppose that more conservatively stated earnings are associated with higher P/E ratios.

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## Appendix: Adjusted Price-Earnings and Dividends Ratios Plots (S&P Data, 1880-2010)

**Figure 1: Historical adjusted P/Es plot**

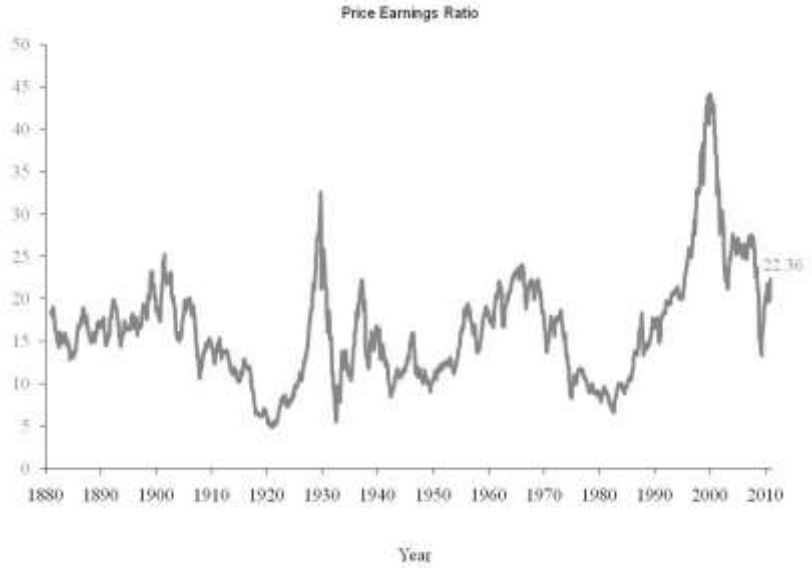
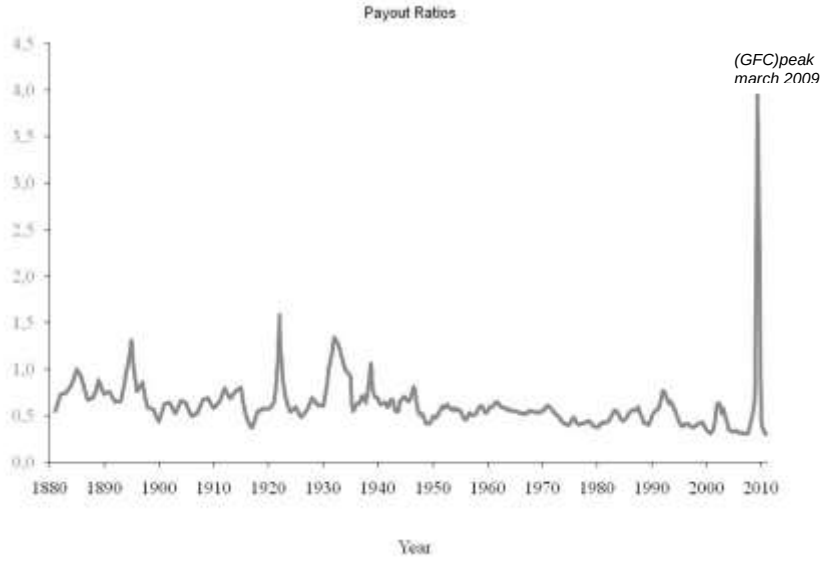
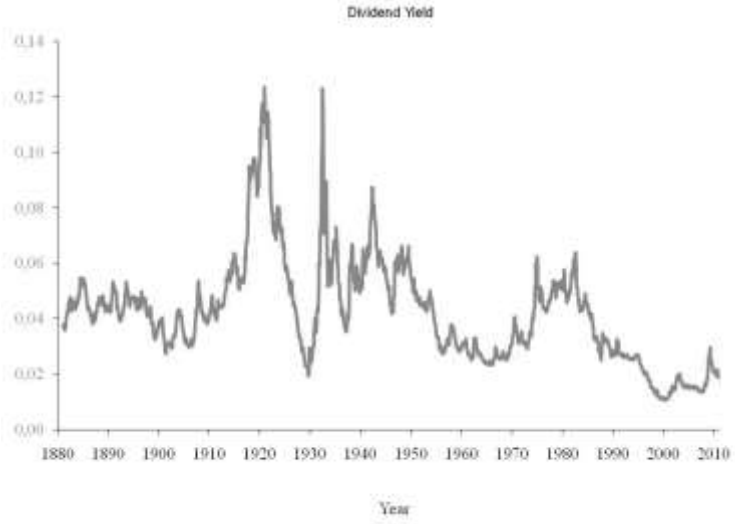



**Figure 2: Historical Payouts plot**



## Figure 3: Historical Dividend Yield plot




Re-elaboration of data used in Shiller, RJ, *Irrational Exuberance*, Princeton University Press, Broadway Books, 2005 (updated); direct sources: *http://www.econ.yale.edu/~shiller/data.htm* and *http://www.standardandpoors.com*.