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Fundamentals Efficiency of the Italian Stock Market: Some Long Run Evidence

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Abstract

A predictive regression approach is adopted to test fundamental efficiency of the Italian equities market on a new long run (1913 to 1999) time series of returns and fundamentals, namely dividend price, earnings price, and price to book. Univariate and vector autoregression significance is tested with Monte Carlo and bootstrapping simulation methods. Some evidence of predictability of stock returns is found especially with respect to the price to book ratio.

Key words: dividend yield; price earning; price to book ratio; VAR; long horizon predictive regressions

JEL classification: G10

1. Introduction

We report some exploratory evidence about fundamental efficiency in the Italian Stock Exchange based on a new and unique database. Working on new data is considered one way to avoid data snooping, especially in the ever flourishing literature about stock return predictability; see Ang and Bekaert (2001) and Rey (2004). Although recently there has been a spate of papers proposing new econometric methods for testing stock return predictability, all these new models have been applied to US data; see for instance Goyal and Welch (2006), Campbell and Yogo (2005a, 2005b), Boudoukh et al. (2005), Moon et al. (2006), and Cochrane (2006).

Studying predictability of US equity returns with respect to the fundamentals information set has become the main research objective of several generations of financial economists in US finance academia. Foreign equities markets have been generally neglected by mainstream economists—Campbell and Shiller (1998) being an exception though they consider a short time series—because they are relatively

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much smaller and because few have long, ready-to-use time series. Hence, correcting the mistakes of econometric methods developed to cope with US data shortcomings becomes a goal of the next generation of econometrics students.

For these reasons, the exploratory evidence that we report below is derived using well known and widely used and cited econometric methods; see Goetzmann and Jorion (1993) and Goetzmann and Jorion (1995) for correcting small sample bias in predictive regressions and Hodrick (1992) for coping with "persistent" (unit root) regressor problems. We show how these methods are suitable for studying our new dataset.

We study the predictive ability of three of the most used fundamentals ratios, namely dividend price D/P, earnings price E/P, and price to book P/B, with respect to the long run returns of Italian equities. Although the first two series show a persistent (unit-root-like) behavior, they have a very low—if not zero—predictive ability with respect to returns. The econometric methods used are due to Goetzmann and Jorion (1993, 1995), who take into account the persistent regressor problem only indirectly, while Torous et al. (2004), Valkanov (2003), and Moon et al. (2006) apply a local-to-unity framework to predictive regressions. Moreover, the methods used in our study consider only indirectly the predetermined regressor problem, which is the focus of Lewellen (2004) and Stambaugh (1999). While these two strands of literature cope with only one of these two econometric problems at a time, assuming either exogeneity or stationarity of the regressor, Campbell and Yogo (2005a) propose a method that tackles both issues in the same efficient test.

More recent methods have been devised to correct spurious evidence of predictability of the models that we use in this article. However, since in our case earlier methods do not yield any evidence supportive of return predictability, we considered it unnecessary to apply either a local-to-unity framework to D/P and E/P series or the Stambaugh (1999) correction for predetermined regressors. Instead, finding evidence of stationarity in the P/B series, we show a certain predictive ability both according to classical inference and to simulated empirical sizes. Our evidence for P/B is another original contribution of this article, as studies of this fundamental ratio are few; see Pontiff and Schall (1998) and Kothari and Shanken (1997). We do not entertain a test of the price to book log linear model of Vuolteenaho (2000) but rather follow the spirit of describing exploratory evidence without superimposing heavy structure on the new data. For the same reason, we do not test the time series relation between price and intrinsic value of the index as in Lee et al. (1999).

Aware that unit root tests have low power, we study the influence of a unit root regressor in a VAR framework similar to that in Hodrick (1992). In the same framework, we study the additional predictive ability of each of the three ratios in the presence of lagged returns and interest rates. We do not examine multiple regressions such as those reported in Lamont (1998) due to the procedure followed in preparing the fundamentals ratios time series.

This article is organized as follows. In Section 2 we describe the procedures followed to collect data and reconstruct the fundamental ratios. Since these time series and the method adopted to construct them are the main original contribution of this article, their statistical properties are thoroughly investigated. In Section 3 we report the econometric methods adopted and results obtained. In Section 4 we draw the main conclusions.

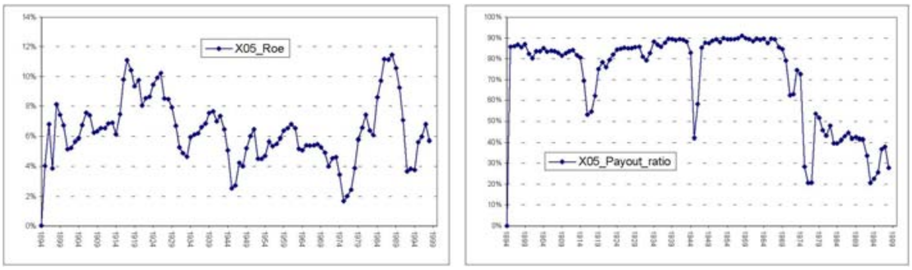
2. Data Collection, Reconstruction, and Description

Any approach to testing fundamental efficiency in the stock market requires a long run time series. In practice, fundamentals are low frequency data, at most quarterly as in US stock exchanges or annual as in the Italian stock markets. Moreover, only over the long haul can predictive regressions detect the fundamental signal sorting out noise. As a consequence, it is necessary to deal with time series that go very far back in time even if this means mixing altogether several tax regimes and corporate governance systems. On the other hand, in order to give more power to the estimators, a larger number of observations can be obtained by sampling relevant time series with a finer frequency than annually. Considering the calendar anomalies induced by a futures-like monthly negotiations system used until 1994 (see Barone, 1990), we adopt monthly sampling for our analysis over the period 1913 to 1999.

These considerations lead us to the reconstruction of a monthly time series of stock returns by splicing together general stock market indices. Between 1913 and 1954 the general index considered is the one reported in Rosania (1954), henceforth called Bank of Italy Rosania (BIR). It was constructed between 1913 and 1937 using ex post backfilling and its base in the remaining period was updated and published regularly by the Bank of Italy. This general index reports not only the price levels, corrected for the last dividend paid, but also the dividend yield corresponding to the stocks included in the base of the index. The BIR index was spliced with the general index computed by the Banca Nazionale del Lavoro (BNL) with base December 31, 1953 set to 100. This is a fixed base index that was discontinued in the first months of 2000 by BNL since its base was no longer representative of the stock exchange as a whole. We have chosen the BNL index since this too was computed with a dividend yield.

To compute price earnings and price to book ratios, we consulted financial yearbooks. About 21,000 balance sheets between 1894 and 1999 were hand collected and analyzed. Since neither the Bank of Italy nor the BNL disclose the names of the companies included in their indices, we could not reconcile precisely the general indices mentioned above with the balance sheets of the companies composing them. However, companies for which we collected accounting data were never less than 50% of the listed stocks. Moreover, this coverage percentage increases when considering capitalization, with the largest listed companies being those sampled. In conclusion, the accounting data collected are certainly representative of the profitability, return on equity (ROE), and the dividend to earnings payout ratio (D/E) of the companies in the two general indices that were spliced together; see Figure 1 for time series of the medians of both series.

Figure 1: Time Series of the Medians of ROE and of payout ratio, 1894-1998



Notes: Figures illustrate annual observations of ROE (left) and D/E (right). Figures are medians of annual samples totaling 21,000 year-firm observations hand collected from *Il Taccuino dell'Azionista, Colombi-Sasip -Databank -Radiocor, Il Calepino dell'azionista, Mediobanca, Il Repertorio delle notizie statistiche sulle societa' anonime in Italia* of Credito Italiano and Assonime.

The price earnings and price to book ratios were reconstructed indirectly. Multiplying the dividend yield time series for the median payout ratio computed in the yearbooks, we obtain the earnings price ratio:

$$\frac{E_{t-1}}{P_t} = \frac{D_{t-1}}{P_t} \times \frac{E_{t-1}}{D_{t-1}}, \tag{1}$$

where E_{t-1}/D_{t-1} is the median value of the payout ratio. Multiplying the latter ratio by the median return on equity ratio, we obtain the price to book ratio:

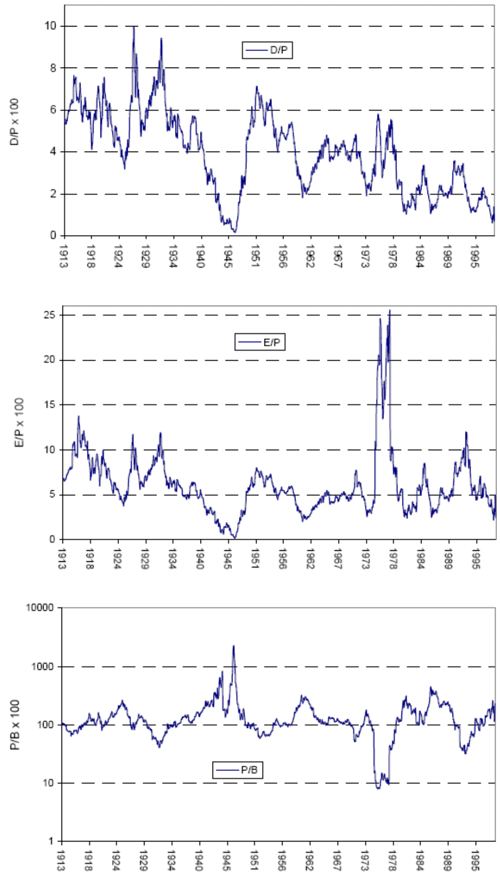
$$\frac{P_t}{B_{t-1}} = \frac{P_t}{E_{t-1}} \times \frac{E_{t-1}}{B_{t-1}}, \tag{2}$$

where P_t/E_{t-1} is the inverse of the earnings price ratio computed in equation (1) and E_{t-1}/B_{t-1} is the median ROE. Time series of E_{t-1}/P_t and of P_t/B_{t-1} are illustrated in Figure 2.

It is worth noting that accounting data were collected for July of each year, the month that balance sheets are approved at shareholder meetings. Hence it is reasonable to consider this as the month in which the fundamentals data set is updated. The alternative choice, the previous end of the year, would have implied a sort of perfect foresight by the representative investor; see Pontiff and Schall (1998, p. 143). However, the proposed solution may imply conservative estimates in the data set. Procedures similar to those followed in (1) and (2) have been adopted in the literature; see for instance Campbell and Shiller (1988) who compute earnings, Goetzmann and Jorion (1993) who calculate dividends using the difference between a total return and a capital gain only index, and Vuolteenaho (2000, p. 7) who uses the clean surplus relation for the book value time series.

Short-term interest rates together with inflation complete the data set of the representative investor in our model. As a proxy for the short-term interest rates, we choose the nominal official discount rate of the Bank of Italy. This series has been reconstructed since 1894, the year in which the Bank of Italy began operating.

Figure 2: Scaled time series of D/P , E/P , and P/B , 1913-1998



Notes: Monthly dividend price time series were reconstructed by splicing together the BIR general Index for 1913-1953 and the BNL general index for 1953-1998. Earnings price and price to book series were reconstructed indirectly as $E_{t-1}/P_t = (D_{t-1}/P_t)\times(E_{t-1}/D_{t-1})$ and $P_t/B_{t-1} = (P_t/E_{t-1})\times(E_{t-1}/B_{t-1})$.

Inflation time series were reconstructed on a monthly basis since 1870 by splicing together the series reconstructed ex post by Cianci (1933) when the Italian Bureau of Census (ISTAT) constituted a separate entity and the ISTAT consumer inflation time series computed from 1928 to 1999. Note that between 1942 and 1948, ISTAT did not publish inflation indices. To fill this gap we use indices reconstructed by the Research Department of the Bank of Italy and published in its Annual Report to the Shareholders for 1946 to 1948. These quarterly series are the only documentary evidence of the most severe hyperinflation to occur in Italy.

The time series studied in this article have never before been used in the finance literature. Hence, we believe it is important to report descriptive statistics both to explore the new data set and to justify the choice of the econometric methods adopted in the following section. These summary measures are presented in Table 1.

Table 1: Summary Statistics for All 1020 Monthly Observations, 1913-1998

A. Measures of center, spread, and date of occurrence (%)							
	D/P	E/P	P/B	DRR	DRN	Ret_n	Ret_r
Mean	4.00	6.10	146.70	−1.90	6.80	15.50	4.00
SD	1.90	3.40	150.80	15.10	3.90	51.80	39.30
Min	0.00	0.20	8.00	−70.20	3.00	−60.70	−74.70
Min Date	05/31/1945	03/31/1947	09/30/1975	02/29/1944	12/31/1933	03/31/1948	12/31/1945
Median	4.10	5.50	113.10	0.70	5.00	7.80	−1.60
Max	10.00	25.50	2265.20	44.00	19.00	843.50	529.40
Max Date	12/31/1926	12/31/1977	03/31/1947	08/31/1927	03/31/1981	04/30/1947	04/30/1947
B. Correlation Matrix							
	D/P	E/P	P/B	DRR	DRN	Ret_n	Ret_r
D/P	1.000	0.547	−0.461	0.306	−0.374	−0.159	−0.026
E/P		1.000	−0.480	0.171	0.165	−0.117	−0.047
P/B			1.000	−0.313	−0.018	−0.002	−0.145
DRR				1.000	0.180	−0.096	0.181
DRN					1.000	0.050	0.089
Ret_n						1.000	0.866
Ret_r							1.000
C. Dickey Fuller *t*-statistics							
	D/P	E/P	P/B	DRR	DRN	Ret_n	Ret_r
AR model	−1.392	−1.923	−3.916	−2.309	−0.737	−6.836	−6.798
AR model with constant	−2.327	−3.723	−5.549	−2.329	−1.388	−7.168	−6.840
AR model with constant and time trend	−3.251	−3.747	−5.547	−2.402	−1.455	−7.172	−6.886

Notes: D/P denotes dividend yield, E/P denotes earnings price ratio, P/B denotes price to book ratio, DRR denotes real short-term rate, DRN denotes nominal short-term rate, Ret_n denotes nominal stock market return over last 12 months, and Ret_r denotes real stock market return over last 12 months. Dickey fuller critical values, at levels 1% and 2.5% respectively, are: −2.58 and −2.23 for the AR model, 3.43 and 3.12 for the AR model with constant, and 3.96 and −3.66 for the AR model with constant and time trend (Greene, 1994, p. 565).

Panel A in Table 1 presents center and dispersion measures with corresponding dates to single out periods with higher market volatility. Clearly in the first period (1913 to 1953) stock market returns and corresponding fundamentals were extremely volatile due to the two world wars and the Great Depression (beginning in 1929). Moreover, it is worth noting that volatility was much higher for real than for nominal time series due to ensuing periods of deflation (in the 1930s) and hyperinflation (in the 1940s). During the WWII hyperinflation period (1946 to 1947), we observe extreme outliers both for fundamentals (see Figure 2) and for stock market returns. Ranges in the following period (1953 to 1999), not reported, are much narrower.

Since one of the goals of this article is to provide additional information concerning fundamental ratios other than dividend yields, we report the correlation matrix of simultaneous levels of fundamentals and interest rates; see Panel B. Despite the way in which they were constructed, fundamental ratio correlations are not very high.

Since non-stationarity has a negative impact on predictive regression statistics, we report three Dickey Fuller tests, see Greene (1994, p. 565). From the *t*-statistics reported in Panel C and standard choices of significance levels, it is evident that for the D/P ratio we cannot reject the null of a unit root. This confirms the downward trend in dividend yield observed in Figure 2, which was caused by a sharp decline in firm payout policies after the mid 1960s due to stricter dividend taxation; see also the payout ratio series in Figure 1. From this point of view, our evidence is similar to what is reported, for instance, by Fama and French (2002). Test results for E/P are mixed; one out of three tests rejects the null of a unit root. All three tests for P/B reject the null of non-stationarity. Hence, the price to book ratio appears to be the only fundamental indicator that is not sensitive to the supposed downward secular trend in equity premiums and/or payouts. Moreover, its volatility is comparable to though larger than the standard deviation for the return series. Because of these features, the local-to-unity framework of, for instance, Moon et al. (2006), is not appropriate for implementing predictive regressions with the P/B ratio.

3. Econometric Methods and Results

A very simple heuristic observation is at the base of any study of fundamental efficiency in equity markets: high (low) levels of D/P and E/P or low (high) levels of P/B are followed by high (low) returns of the stock market. In our time series, anecdotal evidence confirms this regularity. For instance, in the bull markets which ended in speculative bubbles, such as those of 1925, 1946, 1961, 1974, 1981, 1986, and 1998, the peak of the bubble was reached with very low levels of dividend yield and earning price ratios and very high levels of the price to book ratio. These levels of fundamental ratios were followed by crashes. In bear markets, such as 1930-1933, 1949-1952, 1975-1977, and 1990-1992, the market reached the troughs with very high levels of D/P and E/P and low levels of P/B. These levels of fundamental ratios were a harbinger of much higher returns in the following years.

We formalize this heuristic reasoning by adopting the Gordon (1962) dividend discount model to help us to single out influences on expected returns. In a nutshell, this dividend growth model values equity as the present value of an annuity of dividends growing at the rate $g < \rho$, where ρ is the expected return on the stock:

$$P_t = \frac{D_t}{\rho - g}. \tag{3}$$

The three fundamental ratios considered in this article can be expressed as functions of these model variables:

$$\frac{D_t}{P_t} = \rho - g \, , \tag{4}$$

$$\frac{E_t}{P_t} = \frac{\rho - g}{1 - pb} \, , \tag{5}$$

$$\frac{P_t}{B_{t-1}} = \frac{ROE - g}{\rho - g} \, . \tag{6}$$

where D_t is the dividend at time t, E_t is the earnings per share at time t, ρ is the expected return on the stock, g is the dividend growth rate with $g < \rho$ (it is the same for all accounting variables of a firm), $pb = (E_t - D_t)/E_t$ is the plowback ratio with $0 \leq pb < 1$, and $ROE = E_t / B_{t-1}$ is the return on equity or earnings over book value.

From equation (4) it is evident that higher levels of D/P correspond to higher expected returns ρ for the same levels of growth rate g. Conversely, for the same level of ρ, a higher growth rate corresponds to a lower dividend yield. Similar reasoning describes the relationships between ρ, g, and E/P in equation (5). In addition, one can identify the influence of the dividend policy pb: The higher the plowback ratio, the higher the E/P ratio. Finally, from equation (6) we conclude that a higher level of the P/B ratio results from, ceteris paribus, a lower expected return. The influence of g on the P/B ratio depends on how ROE and ρ are related. If $\rho < ROE$, then growth is economically viable and it increases P/B; otherwise, it simply destroys value and decreases the price to book ratio. If $\rho = ROE$, then $P/B = 1$ and growth has no influence on valuation. From this reinterpretation of the dividend growth model, we conclude the following.

(1) Fundamentals ratios are sufficient statistics for a number of variables simultaneously:
  (a) The dividend yield ratio: both expected returns ρ and dividend growth g influence D/P simultaneously. Hence, any linear relationship between D/P and returns computed at a given horizon is affected by expected dividend growth.
  (b) The earnings price ratio: the predictive ability of E/P is blurred by the influence of the dividend policy.
  (c) The price to book ratio: in addition to the dividend yield and the earnings price ratios, dependence on the accounting return is observed. Hence, it is possible to compare the accounting return on equity with the expected market return. High (low) levels of P/B correspond only to ROE above (below) ρ. Expectations about g lever this $ROE - \rho$ effect.

(2) Adopting a rational pricing view and assuming that ratios track time variation in discount rates based on constant expectations about g, pb, and ROE (see Lewellen, 2004, p. 210), we consider the univariate regression:

$$R_{t,\,t+h} = \alpha_h + \beta_h (X)_t + \varepsilon_{t,\,t+h}, \tag{7}$$

where $R_{t,t+h}$ is the return between month t and month $t+h$, $h = 12,\ldots,48$, and X is the fundamental ratio D_{t-1}/P_t, E_{t-1}/P_t, or P_t/B_{t-1} at time t. We anticipate the following signs of the slopes:

(a) For D_{t-1}/P_t and E_{t-1}/P_t, we expect $\beta_h > 0$.

(b) For P_t/B_{t-1}, we expect $\beta_h < 0$.

Predictive regressions such as those in equation (7) involve several econometric problems. The first problem is that overlapping returns induce autocorrelation in the residuals, which inflates classical ordinary least squares (OLS) statistics. The second problem is caused by the intrinsic nature of fundamental ratios and their endogeneity with respect to the regressor. In practice, the same level of price used to compute the fundamental ratio is used to compute the return at the following time point, resulting in a predetermined variable effect. A third problem is due to the persistent behavior—if not unit root—of the fundamental ratios exhibiting a low volatility relative to the regressand. Due to these problems, classic econometric inference may give spurious results.

Among the solutions suggested in the literature for the first kind of problems, we adopt White (1980) standard errors (SEs) to correct for heteroscedasticity of residuals and Newey and West (1987) SEs to take into due account autocorrelation in residuals induced by the use of overlapping returns. To address the second problem, we use bootstrapping simulation methods; see Davidson and MacKinnok (1993) and Goetzmann and Jorion (1993, 1995) for applications to dividend yield regressions. For the non-stationarity issue, Goetzmann and Jorion (1995, p. 489) claim that their method is robust with respect to near integration of the regressand. Moreover, P/B cannot be considered non-stationary, while the other two are not suitable for a local-to-unity framework; see (Torous et al., 2004, p. 938). Therefore, we prefer to examine to our new data using well-known and well-studied econometric methods.

The bootstrapping methods that we adopt derive the distribution of the estimate of β_h under the null hypothesis $H_0 : \beta_h = 0$. By comparing the actual parameter estimate with this distribution, we get an estimate of the Type I error. Following Valkanov (2003), we do not pursue the same procedure for *t*-statistics since they do not converge to well-defined distributions with adequate power and size.

The first bootstrap method is called a fixed dividend yield. In this method, we re-sample actual monthly returns. This re-sampling may take place with or without replacement. When re-sampled, this return time series is re-integrated into a new time series of price levels. We repeat this procedure 2,000 times to create a distribution of β_h estimates under the null of no predictability of stock returns at various horizons. Then we compute relative frequencies of estimates above that observed for D/P and E/P and below that observed for P/B. These frequencies estimate Type I error probabilities: the lower these estimates, the lower the probability to reject the null when this is true.

This first simulation method has an obvious shortcoming: it does not consider the relationship between the accounting variables (e.g., dividends, earnings, book values) and the price level. As a consequence, these time series statistical properties are completely ignored since these variables are considered only in ratios and not by themselves. Moreover, regressor endogeneity is no longer a problem when the price level for computing the ratio and the one for computing returns are different. For these reasons, Goetzmann and Jorion (1993, 1995) propose a bootstrapping method called fixed dividend.

In the second simulation approach, the fundamental ratio is computed by dividing the actual dividend (or other fundamental) time series by index levels computed integrating bootstrapped monthly returns, re-sampled with or without replacement. In this way, for every bootstrapping experiment we obtain a series of returns, regressands, and fundamentals ratios computed from the same returns simply by dividing the accounting variable by the time series of the re-integrated index levels. Again, the procedure is replicated 2,000 times. Using the resulting parameter estimates, we compute relative frequencies to gauge the level of significance of actual parameter estimates under the null hypothesis of no predictability of returns.

The econometric methods detailed above are applied to the time series described in Section 2. For brevity, only some of the most significant results are reported in Table 2. Equation (7) is estimated on both real and nominal returns. Moreover, since the reconstructed index is the result of splicing two indices computed by two different institutions, we also estimate equation (7) for both periods 1913-1953 and 1953-1999 to identify possible differences in results.

Table 2: Fundamentals Univariate Regressions

		t-statistics					Bootstrap Betas	
Horizon	$\hat{\beta}_h$	OLS	W	NW	R^2	$\Pr(b_{boot1} > b_t)$	$\Pr(b_{boot2} > b_t)$	$\Pr(b_{boot3} > b_t)$
Dividend Yield Regressions								
Real Returns General Series, 1913-1998								
1	0.123	0.991	0.777	0.424	0.001	0.423	0.164	0.171
6	0.653	1.886	1.414	0.586	0.003	0.422	0.205	0.186
12	1.438	2.724	2.153	0.853	0.007	0.418	0.161	0.168
24	3.342	4.471	4.311	1.689	0.019	0.352	0.111	0.121
36	4.836	5.242	5.185	2.015	0.027	0.363	0.142	0.134
48	4.974	4.675	4.588	1.767	0.022	0.412	0.183	0.196
Real Returns General Series, 1913-1953								
1	0.356	1.842	1.113	0.609	0.007	0.148	0.029	0.036
6	1.680	3.180	1.817	0.755	0.020	0.218	0.064	0.068
12	3.132	4.074	2.447	0.975	0.034	0.235	0.071	0.073
24	5.707	5.711	4.485	1.776	0.065	0.264	0.103	0.090
36	7.275	5.879	5.370	2.118	0.071	0.276	0.130	0.139
48	7.731	5.576	5.439	2.115	0.066	0.325	0.182	0.171

Horizon	$\hat{\beta}_h$	*t*-statistics OLS	W	NW	R^2	$\Pr(b_{boot1} > b_t)$	Bootstrap Betas $\Pr(b_{boot2} > b_t)$	$\Pr(b_{boot3} > b_t)$
Earnings Price Regressions								
Real Returns General Series, 1913-1953								
1	0.140	0.992	0.655	0.359	0.002	0.346	0.174	0.161
6	0.640	1.651	1.040	0.433	0.006	0.423	0.229	0.235
12	1.214	2.142	1.419	0.564	0.010	0.410	0.233	0.226
24	2.426	3.273	2.682	1.056	0.022	0.440	0.216	0.234
36	2.819	3.081	2.732	1.070	0.020	0.486	0.270	0.283
48	2.673	2.611	2.308	0.892	0.015	0.552	0.339	0.312
Nominal Returns General Series, 1954-1998								
1	-0.056	-0.781	-0.677	-0.414	0.001	0.981	0.787	0.801
6	-0.166	-0.840	-1.085	-0.466	0.001	0.952	0.663	0.645
12	0.082	0.263	0.305	0.121	0.000	0.847	0.447	0.489
24	0.837	1.786	1.806	0.704	0.006	0.693	0.283	0.283
36	2.008	3.554	3.735	1.462	0.025	0.583	0.174	0.145
48	3.210	5.008	5.143	2.006	0.049	0.505	0.106	0.111
Price to Book Ratio Regressions								
Real Returns General Series, 1913-1998								
1	0.002	1.288	0.469	0.262	0.002	0.000	0.109	0.102
6	-0.023	-5.388	-2.331	-1.113	0.028	0.963	0.997	0.989
12	-0.061	-9.585	-7.813	-3.566	0.083	0.978	0.999	0.999
24	-0.075	-8.256	-4.545	-2.079	0.063	0.944	0.996	0.994
36	-0.080	-7.092	-4.699	-2.120	0.048	0.939	0.979	0.982
48	-0.088	-6.796	-4.499	-2.008	0.045	0.925	0.973	0.970
Real Returns General Series, 1913-1953								
1	0.002	1.144	0.448	0.250	0.003	0.015	0.128	0.138
6	-0.027	-5.119	-2.277	-1.100	0.051	0.872	0.990	0.993
12	-0.065	-8.949	-6.901	-3.220	0.143	0.898	0.999	0.999
24	-0.066	-6.611	-3.875	-1.794	0.086	0.836	0.979	0.979
36	-0.061	-4.874	-4.060	-1.869	0.050	0.758	0.935	0.931
48	-0.064	-4.612	-3.816	-1.725	0.046	0.573	0.869	0.881

Notes: Values in column $\hat{\beta}_h$ are estimates of the slope in equation (7). OLS *t*-statistics use classical SEs, W *t*-statistics use SEs adjusted for heteroscedasticity based on White (1980), and NW *t*-statistics use SEs adjusted for autocorrelation and heteroscedasticity based on Newey and West (1987). The last three columns report size estimates for the three bootstrap procedures: fixed dividend with earnings and book value ($boot1$), fixed dividend yield with earnings price and price to book with replacement ($boot2$), and fixed dividend yield with earnings price and price to book without replacement ($boot3$). For P/B regressions, since the coefficient estimate is negative, the size is 1 minus the value reported.

In general, parameter estimates for nominal returns do not have the expected signs and they are not significant when compared to empirical quantiles computed through the bootstrap methods. Nevertheless, parameter for real returns are quite significant for the entire period 1913-1999 and for both subperiods. Signs of $\hat{\beta}_h$ are generally those expected—i.e., positive for dividend yield and price earnings and negative for the price to book ratio, although significance levels vary with the fundamental ratio. In general, the fixed dividend procedure is more conservative than the fixed dividend yield. Regressions on E/P are the least significant with a low level of R^2 and generally low significance levels, particularly on shorter horizons. In contrast, D/P regressions have a relatively higher level of significance. The fundamental ratio that seems to be the most reliable in predicting stock returns, however, is P/B. This is confirmed by all the statistics we computed. The Newey-West-adjusted *t*-statistics are extremely high, indicating strong evidence of correlation between returns and P/B. Naturally, high values of R^2 are observed for this ratio, not only relative the other fundamentals regressions considered here but also relative to analogous estimates in US markets; see for instance Pontiff and Schall (1998) and Kothari and Shanken (1997). Both bootstrapping methods with few exceptions consistently indicate high levels of significance between 1% and 15%.

It is worth noting that most of the parameters estimates with unexpected signs or with low levels of significance are for regressions with short horizons. This evidence supports the conjecture that the predictive ability of fundamentals is effective only for medium- to long-term horizons. In contrast with the other fundamentals considered here, the P/B coefficients estimated at different horizons do not show a monotonic increasing pattern, indicating a statistical artifact—see Boudoukh et al. (2005, p. 22)—but are very stable over the 12- to 48-month intervals. Finally, we observe that this univariate predictive regressions evidence is influenced by outliers in a crash and rebound effect that is also observed in US time series; see for instance Goyal and Welch (2003).

In order to test the additional predictive ability of individual fundamental ratios when included in the information set of an investor, we adopt a vector autoregression (VAR) approach. This model too is robust with respect to near integration in the regressor and to the predetermined variable effect; see Goetzmann and Jorion (1993, p. 675). In this way, predictiveness of individual fundamentals are tested together with past stock returns and current interest rates.

Past stock returns and current interest rates are chosen according to the following motivations. First, in recent literature, stock returns have been observed to deviate from white noise and stock prices do not follow a random walk, as was commonly accepted in the 1960s literature; see Lo and MacKinlay (1999). Instead, over the medium to long run, stock returns can be easily predicted. For instance, according to Fama and French (1988), stock returns are negatively autocorrelated over the medium to long run while they are uncorrelated over the short and the long run. This is the result of the mixture of a long and a short run component; the former is predictable, the latter is not.

We include short-term interest rates; see Campbell (1991) and Ang and Bekaert (2001). In the US and the UK markets, the sign of the coefficient of this regressor on stock returns is negative for both real and nominal rates; see Modigliani and Cohn (1979). It is worth noting though that this negative relationship is normal only in those financial markets in which real interest rates have been normally positive and nil or negative only for very short periods. This is not the case of the Italian financial market, where real returns on both short- and long-term fixed income have been deeply negative for very long periods, for instance in 1915-1925, 1939-1948, and 1973-1981. In these periods, equities were perceived as any other financial investment with their value not keeping pace with inflation. Hence, after a few years of sagging prices, the real and sometimes even the nominal values of the equities investment were reduced, such as in 1915-1925, 1942-1944, and 1973-1978. Domestic investors, unable to convert liras into a foreign currency due to capital export restrictions, suddenly discovered equities as a safe shore for their savings against hyperinflationary storms. This sudden change of attitude with respect to stocks investment lead to steep price increases that ended in speculative bubbles stemming from an undervaluation to an overvaluation of the listed companies.

Because of these peculiar features of the Italian financial system, the negative relationship between stock and fixed income returns, usually observed in the US and UK, cannot be expected in the Italian stock markets. In fact, it is not observed, as shown below.

The estimated VAR is:

$$\begin{bmatrix} R_{t,\,t+12} \\ D_t/P_t \\ r_{f,\,t} \end{bmatrix} = \begin{pmatrix} a_{10} \\ a_{20} \\ a_{30} \end{pmatrix} + \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{bmatrix} R_{(t,\,t+12)-1} \\ (D_t/P_t)_{-1} \\ (r_{f,\,t})_{-1} \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \\ u_3 \end{bmatrix}, \tag{8}$$

where $R_{t,\,t+h}$ is the stock return from month t to month $t+h$, D_t/P_t is the dividend yield at time t, and $r_{f,\,t}$ is the short-term interest rate. The disadvantage of the VAR approach lies in the difficulty in reconciling estimated parameters to structural models. Hence, although it is easy to specify a null hypothesis of no predictive ability of stock returns, no coefficients are significantly different from zero. It is difficult to specify an alternative; see for instance Hodrick (1992), Goetzmann and Jorion (1993), and Ang and Bekaert (2001). On the other hand, the main advantage of the VAR approach lies in the flexibility of specifying the data generating process (DGP) to derive through simulation empirical power and size of regressions statistics. For instance, in case of non-stationarity of one or more regressor, it is possible to set up a Monte Carlo simulation—see Hodrick (1992)—and derive empirical size and power of diagnostic tests under the assumptions of a DGP as close as possible to the multivariate process observed and estimated in the VAR.

In estimating system (8) we follow Hodrick (1992) and use fundamentals as collected without further transformation. This approach leads to a more immediate and intuitive interpretation of VAR parameters. Equations in system (8) have been estimated using OLS with White-adjusted SEs to cope with heteroscedasticity in the residuals. For every equation we compute a Wald statistic—see Greene (1994, p. 131)—to test the null that all three coefficients are zero. The Wald statistic has a χ^2 distribution with 3 degrees of freedom, one for each restriction imposed.

The econometric methods reported here are applied to the time series described in Section 2 on returns computed over 12 months, the most significant in the univariate fundamentals regressions. As before, results derived on nominal returns are mostly insignificant. Hence we report in Table 3 only VAR estimates for real deflated time series of both returns and interest rates.

The VAR estimates reported in Table 3 are comparable to those reported in Hodrick (1992). The first equation estimates are strongly significant using the Wald test, the *t*-statistics and the R^2, even more so than the results reported by Hodrick (1992, Table 1) for the US. This is true even more for the second subperiod, when the coefficient of determination reaches an impressive 18.8%. In contrast, the inflated R^2 and the Wald tests in the second and third equations are due to unit roots in the corresponding regressor—the fundamental ratio and the short term interest rate. It is worth noting that this does not happen when a VAR is estimated for the P/B ratio over the whole period 1913-1999 or in the first subperiod.

Parameter estimates are as expected: they are positive for dividend yields and earning price ratios and negative for the price to book ratio. Coefficients for interest rates are always positive due to specific peculiarities of the Italian financial system. In fact, negative real interest rates have been observed together with negative stock market returns during inflationary periods. However, positive real interest rates in the 1950s and 1960s and in the 1980s and 1990s have been observed with positive stocks returns. Finally, stock return autocorrelation is always negative and often significant, as expected by Fama and French (1988).

It is interesting to note that the real interest rate negatively influences fundamentals ratios in all VARs estimated for P/B and in the second subperiod for D/P and E/P. This evidence can be explained by re-interpreting the three fundamentals as functions of the variables in the dividend discount model. Recall that ρ, the expected stock return, includes the price for time in addition to the price for risk, with the former following the short-term interest rate. Thus, VAR estimates suggest a high predictability of stock returns via linear relations with fundamentals. Nonetheless, the presence of unit roots mostly in the dividend yield and in the earnings price ratios warn us to be wary in interpreting results reported in Table 3. Hence, following Hodrick (1992), it is necessary to test asymptotic properties of statistics used in a rather small sample, as the one used above.

Next, we test the small sample properties of the Wald statistic used above. For brevity, results are reported for dividend yield VAR only, which is the variable most influenced by unit root problems; see Table 4. We used a Wald statistic (call this Test 4) with a $\chi^2(3)$ distribution in order to test the null hypothesis $H_0 : \beta_j = 0$, $j = 1,2,3$. In addition, similar Wald statistics can be devised. Call statistics for testing nulls of zero for individual regressor, hence with a $\chi^2(1)$ distribution, Tests 1, 2, and 3. The asymptotic properties of these test statistics are derived using a

Monte Carlo simulation of the VAR reported in equation (8). Specifically, we derive the size and the probability of Type II errors. The results are derived under the assumptions of a homoscedastic DGP for the residuals in order to avoid imposing complicated structure on the data; see Wolf (1997, p. 7). We performed 5 different Monte Carlo simulations.

1. **emp1**: The VAR simulated under the null hypothesis that all three coefficients of the first equation in system (8) are all zero $H_0 : \beta_j = 0$, $j = 1,2,3$—i.e., under the assumption of no predictability of stock returns. Expected stock returns is set equal to the value of the intercept plus the shock taken from a trivariate normal with a variance covariance matrix estimated using OLS residuals of the three equations assuming homoscedasticity. In the other two equations, the VAR is considered stationary or without unit roots both in the fundamental ratio and in the interest rate. The other VAR parameters are set equal to OLS estimates.
2. **emp2**: The VAR simulated under the null hypothesis specified in **emp1** but also imposing a unit root in the second equation— i.e., in the fundamental ratio series.
3. **emp3**: The same as **emp2** but also imposing a unit root in the second and third equations—i.e., in both the fundamental ratio and in the interest rate series.
4. **emp4**: Similar to **emp1** and **emp2** but imposing a unit root only in the third equation—i.e., only in the interest rate series.
5. **emp5**: The VAR simulated under the alternative $H_1 : \beta_j = \hat{\beta}_j$, $j = 1,2,3$— assuming predictiveness of stock returns with significant additional contribution by all three regressors.

We performed 2,000 Monte Carlo simulations of the dividend yield VAR over the subperiod 1954-1999 with 528 observations. Results of the simulations are reported in Table 4. For Test 4 in Panel A we tabulate quantiles of a $\chi^2(3)$ together with the four empirical distributions derived from the Monte Carlo simulations. Clearly, quantiles computed for empirical distributions are close to those for the actual $\chi^2(3)$ distribution. They are even closer for the empirical distributions derived with unit roots in the fundamental ratio and in the interest rate (**emp3**).

This observation is confirmed also by the empirical size of the four tests reported in Panel B. While unit roots in the fundamental ratio (**emp2**) induce a limited bias in all four tests, non-stationarity in interest rates—in **emp3** with non-stationary D/P and in **emp4** alone—biases considerably the empirical sizes, especially for Tests 1 and 2. In Panel C we report Type II errors computed with respect to empirical critical values derived under the null in a stationary VAR. The power of three tests over four is very high. Only the Wald test on the predictiveness of the interest rate has a low power, less than 20%. In conclusion, the small sample properties of Wald tests used to test significance of VAR estimates confirms the predictiveness of fundamentals with respect to stock market returns. These results are generally reasonable with the exception of the predictiveness of interest rates.

Table 3: Individual Fundamentals in a VAR

	Dividend Yield VAR						Earnings Price VAR						Price to Book VAR					
	Intercept	$\ln(R_t)$ (SE)	D_t/P_t (SE)	*rbt* (SE)	$\chi^2(3)$ (conf)	R^2	Intercept	$\ln(R_t)$ (SE)	D_t/P_t (SE)	*rbt* (SE)	$\chi^2(3)$ (conf)	R^2	Intercept	$\ln(R_t)$ (SE)	D_t/P_t (SE)	*rbt* (SE)	$\chi^2(3)$ (conf)	R^2
	Real Returns, Dividend Yield, and Short-Run Real Rates						Real Returns, Earnings Price, and Short-Run Real Rates						Real Returns, Price to Book, and Short-Run Real Rates					
	Period 1913-1998																	
$\ln(R_t)$	-0,032	-0,069	0,639	0,410	12,772	0,039	-0,023	-0,068	0,275	0,423	12,823	0,038	0,010	-0,074	-0,005	0,422	13,147	0,038
(SE)	0,025	0,049	0,491	0,127	0,995		0,020	0,049	0,265	0,127	0,995		0,018	0,052	0,011	0,135	0,996	
X	0,006	-0,017	0,834	0,013	3182,122	0,765	0,020	-0,037	0,660	0,030	514,463	0,559	0,970	2,720	0,330	-3,547	251,039	0,397
(SE)	0,001	0,001	0,015	0,002	1,000		0,003	0,003	0,047	0,005	1,000		0,097	0,462	0,075	0,625	1,000	
rbt	-0,017	0,074	0,208	0,527	226,747	0,367	-0,020	0,075	0,191	0,528	232,776	0,368	-0,001	0,069	-0,005	0,523	227,744	0,369
(SE)	0,011	0,019	0,255	0,043	1,000		0,008	0,019	0,105	0,043	1,000		0,006	0,020	0,004	0,043	1,000	
	Period 1913-1953																	
$\ln(R_t)$	-0,090	-0,245	1,109	0,368	25,249	0,087	-0,051	-0,247	0,290	0,418	24,594	0,084	-0,031	-0,250	-0,001	0,431	24,216	0,084
(SE)	0,049	0,067	0,837	0,120	1,000		0,038	0,068	0,504	0,115	1,000		0,020	0,074	0,011	0,134	1,000	
X	0,015	-0,014	0,714	0,021	1412,746	0,710	0,013	-0,022	0,789	0,022	1383,936	0,756	1,188	3,643	0,257	-4,303	62,679	0,420
(SE)	0,002	0,002	0,031	0,003	1,000		0,002	0,002	0,027	0,004	1,000		0,082	0,775	0,062	0,667	1,000	
rbt	-0,134	0,119	2,127	0,364	184,176	0,371	-0,075	0,117	0,813	0,446	191,397	0,354	-0,015	0,104	-0,006	0,477	195,059	0,347
(SE)	0,034	0,033	0,621	0,056	1,000		0,027	0,035	0,376	0,049	1,000		0,010	0,038	0,005	0,047	1,000	
	Period 1954-1998																	
$\ln(R_t)$	-0,156	0,024	4,432	2,552	106,836	0,128	-0,063	0,067	0,824	2,206	66,946	0,110	0,142	-0,007	-0,123	3,032	137,983	0,188
(SE)	0,035	0,047	0,960	0,287	1,000		0,021	0,047	0,275	0,311	1,000		0,022	0,047	0,014	0,318	1,000	
X	0,008	-0,019	0,729	-0,012	911,300	0,736	0,027	-0,048	0,560	-0,132	221,672	0,536	0,285	1,689	0,810	-2,363	2438,048	0,853
(SE)	0,001	0,001	0,028	0,011	1,000		0,004	0,004	0,061	0,059	1,000		0,028	0,073	0,019	0,446	1,000	
rbt	0,014	0,023	-0,326	0,681	628,123	0,603	0,000	0,019	0,042	0,732	446,640	0,596	-0,003	0,022	0,005	0,683	477,888	0,601
(SE)	0,004	0,005	0,094	0,041	1,000		0,003	0,005	0,03	0,039	1,000		0,002	0,005	0,001	0,040	1,000	

Notes: Results are for VAR approach for 1913-1999 and in the two subperiods 1913-1953 and 1953-1999.

Table 4: Small Sample Properties of Wald Tests Applied to VAR Estimates

A. Quantiles of the $\chi^2(3)$ Test Statistic under the Null

Quantile	5%	10%	50%	90%	95%
$\chi^2(3)$	0.350	0.590	2.370	6.250	7.820
emp1	0.273	0.513	2.202	5.222	7.568
emp2	0.482	0.738	2.213	5.070	6.723
emp3	0.350	0.556	2.591	6.161	7.260
emp4	0.303	0.569	2.084	5.024	5.549

B. Observations Greater Than Nominal Critical Values under the Null Hypothesis (%)

	Test 1			Test 2			Test 3			Test 4		
Nominal Size	0.100	0.050	0.010	0.100	0.050	0.010	0.100	0.050	0.010	0.100	0.050	0.010
emp1	0.114	0.034	0.000	0.086	0.034	0.000	0.084	0.047	0.015	0.083	0.049	0.015
emp2	0.080	0.064	0.016	0.096	0.064	0.016	0.080	0.048	0.017	0.083	0.048	0.000
emp3	0.178	0.086	0.000	0.178	0.086	0.000	0.083	0.032	0.000	0.097	0.050	0.017
emp4	0.065	0.016	0.000	0.115	0.019	0.000	0.086	0.037	0.019	0.037	0.019	0.019

C. Simulated Type II Error Rates (ERs) for Tests of size 5% and New Critical Values (CVs)

	Test 1			Test 2			Test 3			Test 4		
	ER	CV 1	CV 2	ER	CV 1	CV 2	ER	CV 1	CV 2	ER	CV 1	CV 2
emp5 and **emp1**	0.000	3.534	4.932	0.000	3.589	4.927	0.846	3.386	3.379	0.000	7.568	6.723

Notes: Results are for 2,000 Monte Carlo simulations of the first-order VAR in equation (8). There were 528 observations over the period 1954-1998. Panel A reports quantiles of a $\chi^2(3)$ distribution for the Wald Test 4 statistic and compares these with corresponding quantiles derived under the null hypothesis of no predictiveness and four specifications of the VAR. Panel B reports that part of the experiments under the null in which computed Wald tests are higher than nominal critical values of a $\chi^2(3)$ for the Wald Test 4 and of a $\chi^2(1)$ distribution for the other tests. Panel C reports quantiles for a $\chi^2(3)$ Test 4 and $\chi^2(1)$ Tests 1, 2, and 3 derived empirically under **emp1** and **emp2** together with the Type II error rates derived under the alternative hypotheses considered.

4. Conclusions

We present exploratory evidence concerning fundamental efficiency in the Italian equities market. We reconstruct monthly stock returns and three of the most used fundamental ratios, namely dividend yield, earnings price, and price to book, for the Italian stock market over the period 1913-1999. We test the predictiveness of these fundamentals in univariate predictive regressions and test the additional predictiveness of fundamentals when considered together with lagged stock returns and interest rates in a VAR approach. Both approaches are verified using bootstrap and Monte Carlo methods. Results show some predictiveness of stock market returns using fundamentals, and the price to book ratio seems to have the most predictive ability. Tests that support univariate regressions and VAR estimates have a comparable or higher significance than those reported for US and UK markets. Extensions of this article should test the predictive ability of fundamentals out of sample as in Goyal and Welch (2003, 2006). Moreover, our new time series seems to be suitable for a structural break analysis such as that in Guidolin and Timmerman

(2005) or Lettau and Van Nieuewerburgh (2006).

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