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INTERNATIONAL EARNINGS TO PRICE RATIO CONVERGENCE: EVIDENCE FROM THE EUROPEAN UNION

Nicholas Apergis, University of Piraeus, Greece
Christis Hassapis, University of Cyprus, Cyprus
Christina Christou, University of Piraeus, Greece
Steve Johnson, Sam Houston State University, USA

ABSTRACT

This paper investigates whether any pattern of convergence of international earnings-to-price ratios that exist for a sample of 19 European Union (EU) countries over the period 1994-2012 can be detected through the methodology of Phillips and Sul (2007). This methodology is based on a general form of a nonlinear time varying factor model and allows for cross sectional heterogeneity as well as for different transitional time paths towards equilibrium. The results show that such a convergence is not present. Next, the study aims at detecting any potential factors supporting the pattern of divergence. The empirical findings reveal that such divergence patterns mainly reflect divergence in economic factors.

JEL: G10, C23

KEYWORDS: Earnings-Price Ratios; Club Convergence; Clustering Procedure; European Markets

INTRODUCTION

Price-earnings ratios measure the willingness of investors to pay for current earnings. They are used either as a valuation tool for assessing stocks vis-à-vis other stocks in terms of growth and risk or determinants in cost-of-capital computations. Bekaert (1995) argues that higher price-earnings ratios imply a stronger degree of market convergence. These ratios have also been widely used as indicators for the quality of investments (Dontoh *et al.*, 1993) as well as indicators of convergent markets. In the case that expected returns from various markets depend on location, they are characterized as segmented (Karolyi and Stulz, 2002). In addition, the P/E ratio has been considered an indicator of transitory earnings, future earnings or risk. If investors' information sets are not homogeneous, low P/E ratios may signal undervalued stocks and portfolios of low P/E stocks should yield excess returns even after they are adjusted for risk. Even assuming non-homogeneous information sets, the hypothesis that all market agents evaluate the price stocks according to a discounted cash flow approach is still a useful benchmark, which can be tested and rejected in favor of alternative hypotheses. Its implications are that the expected growth of earnings and payout (risk and persistence) should be negatively (positively) related to the earning price ratio.

Benefits of market convergence include lower volatility and an increased ability to absorb shocks. In convergent markets the cost of equity capital diminishes, which in turn boosts investments, and accordingly, economic growth. Colacito and Croce (2010) argue that in convergent markets, shocks are at least partially diversifiable across countries. They conclude that the implied benefits of keeping international financial markets open can be as high as ten percent of lifetime consumption. Similarly, Umutlu et al. (2010) demonstrate that increased market convergence results in lower volatility and an increased ability of global markets to absorb risk. Possible costs, or downside effects, of market convergence include fewer

diversification benefits and increased chance of a joint crash across markets. Financial markets that are at least partially convergent place less weight on local risk factors (Carrieri *et al.*, 2007). This may lead to fewer diversification benefits, which might lead to slower stock price gains (Eun and Lee, 2010). Beine *et al.* (2010) find that financial liberalization increases co-movements between markets most strongly during crashes, implying that increased openness in markets increases the likelihood of a joint crash across all markets.

The objective of this paper is, first, to investigate whether earnings-to-price ratios from 19 European Union (EU) countries have been converging over the recent years, and second, if such convergence or divergence patterns can be documented, it is the role of macroeconomic factors that can explain them. The overall related literature acknowledges that EU positive earnings stocks have a P/E ratio around 25, while the expected 1-year ahead rate of growth is highly volatile. Finally, average betas –around 0.8 for European stocks- show that these stocks are not very sensitive to systematic non diversifiable risk. According to Zarowin (1990) and Bildersee *et al.* (1990), earnings-price ratios differ widely across firms, a fact that can be attributed to differences in certain factors such as economic growth and accounting practices. This paper uses the approach of Bekaert and Harvey (1995) who model time-varying market convergence and assess the relative importance of information arising from the above factors on capital market characteristics.

The contribution of this paper to the above-mentioned framework of convergence is that of directly testing the presence of convergence patterns across a number of EU countries. More specifically, this study contributes to the literature by examining a number of countries for which no relevant study, to the best of our knowledge, occurs relative to the convergence of such financial ratios. The second contribution of this study is the employment of a new methodological approach, that of clustering or clubbing panel convergence testing, recommended by Phillips and Sul (2007). This methodology has several advantages. First, no specific assumptions concerning the stationarity of the variables of interest and/or the existence of common factors are necessary. Second, it is based on a quite general form of nonlinear time varying factor models. More importantly, it takes into account that countries experience transitional dynamics, while it abstains from the hypothesis of homogeneous technological progress, an assumption extensively employed in the majority of growth studies (Phillips and Sul, 2006).

Evidence regarding convergence patterns of P/E ratios is relevant for policymaking. The adoption of common fundamentalist rules is of high concern for investors and traders. A deeper understanding of the role of potentially unexplored variables, which may proxy for the unknown part of the fundamental value of the stock in a framework of asymmetric information, may reveal the presence of significant differences in the way stocks are valued across European financial markets.

The remaining of the paper is organized as follows. Section 2 presents a brief literature review while Section 3 discusses the hypotheses tested. Section 4 reports the description of the data used along with the econometric methodology. Section 5 reports the empirical findings and discusses them, while Section 6 concludes the paper.

LITERATURE REVIEW

The concept of convergence is affected by various factors, such as investment factors and macroeconomic factors. More specifically, investment factors are legal barriers that differentiate between foreign and domestic investors (Bekaert, 1995) or other regulatory framework characteristics (Kim and Singal, 2000) or other type of barriers, such as differences in information, in accounting standards and in investors' protection (Bekaert, 1995). For the case of emerging markets there also present barriers related to specific risks, such as liquidity risks, political risks, economic policy risks and currency risks (Bekaert, 1995), while a group of researchers has examined business cycle or macroeconomic factors affecting market convergence. Such factors involve interest rates and income levels (Calvo *et al.*, 1993; Chuhan *et al.*, 1993).

Aydogan and Górsoy (2000) analyze the P/E effect and the explanatory power of the P/E ratio in 19 emerging market countries. To test the P/E effect, they rank the E/P ratios in descending order, then divide the sample into five quintiles. The authors find that, for all return horizons, a significant P/E effect: average returns decreased as the E/P ratio declined. Additionally, the effect was much stronger for longer (12-month) return horizons. Estrada (2003) proposes a new tool that adjusts the P/E ratio by growth and risk. He compares the performance of value strategies based on the P/E ratio, the P/E ratio adjusted by growth (PEG) and the P/E ratio adjusted by growth and risk (PERG). He finds that the portfolio formed based on PERG significantly outperforms the portfolios based on the P/E ratio and PEG. Chahine and Choudhry (2004) verify whether value outperforms growth strategies across all euro-zone countries. They argue that a high P/E ratio may result two things: first, from a high price relying on expected future cash flows, or second, from a sudden decrease in the earnings level not yet included in the stock price. They find that value stocks (low P/E level) with high earnings growth record the highest performance whereas growth stocks (high P/E ratio) with low earnings growth show the lowest performance. They conclude that the strategy of selling short shares with a price to earnings growth (PEG) ratio higher than one and buying shares with a PEG ratio less than one out performs other strategies.

In another strand of the relevant literature, Campbell and Shiller (1998) show that the ratio of long-run moving average of earnings to the current stock price is negatively associated with future stock returns, while Bekaert *et al*. (2007) show that country-specific growth opportunities are capable of predicting future output and investment growth. By contrast, others find that, at the firm level, the driving force for convergent trends can be primarily explained by the accounting practices employed in the participating capital markets (French and Poterba, 1991; Land and Lang, 2002). The desire for convergence of accounting standards is greater than ever. Convergence aspires to, ultimately, all standard setters agreeing on a single set of high quality accounting standards applied even-handedly. This is expected to greatly reduce uncertainty about comparability of published accounts, while enhancing the transparency of information to the market place. Anderson and Brooks (2006) show that although P/E ratios have been calculated on the basis of the previous year's earnings, the power of the effect has until now been seriously underestimated due to taking too short-term a view of earnings. They use data from all UK firms since 1975 and the traditional P/E ratio and their empirical findings display that the difference in average annual returns between the value and glamour deciles to be 6%. They are able to almost double the value premium by calculating the P/E ratio using earnings averaged over the previous eight years.

Giannetti (2007) studies the predictive ability of the E/P ratio for the S&P 500 Index. He does so by estimating a linear market-timing model, which relates the stock's return to the previous E/P ratio and the latest change in the ratio. The E/P level illustrates the long-term profitability, while the change in the ratio acted as proxy for shorter economic fluctuations. He finds that the earnings price ratio effectiveness as the index returns predictor had spectacularly declined from 1997 to 2002, which may be interpreted in either a rational risk premium or an investor sentiment type framework. Furthermore, he documents strong evidence for market timing ability for unconstrained (no restrictions on short selling and leveraged positions) strategies. Modares et al. (2008) analyze the relationship between different financial ratios and the excess rate of return. For the Teheran Stock Exchange from 2001 to 2004, they find significant results showing that the E/P ratio has a meaningful relationship with the excess rate of return and that it can explain part of the change in the excess rate of return. Azhar et al. (2009) move away from using the traditional P/E ratio to predict future stock returns. They find it problematic to use the traditional P/E ratio because as it is not a symmetric, proportional and scaled measure, and can lead to measurement errors in empirical analysis. Instead, they design a geometric tool and apply the traditional P/E ratio in this framework to arrive at a measure that is free of the problems mentioned above. They estimate a model with data between 1872 and 2008 and conclude that using the geometric version of the P/E ratio is a better measure than the traditional P/E ratio for predicting future returns.

Finally, the literature has offered a number of studies that assess the merit of the P/E ratio as a predictor of stock returns. Although the literature prior to 2000 is extensive, we offer the most recent studies on the issue. In particular, Saleh (2007) examines the performance of the value-growth strategies based on two measures: earnings-to-price and divided-to-price. He uses the CAPM and the Fama-French three-factor model to investigate the ability of these two measures to explain the cross-sectional stock returns. Inconsistent with previous research he provides evidence suggesting that the SMB and HML factors are not significant when he sorted stocks based on E/P and D/P ratios. He attempts to explain such findings by using a multi-factor model, the Fama-French three-factor model augmented with liquidity, leverage, volatility, and winner-loser effects. Jiang and Lee (2009) investigate the prediction of excess returns and fundamentals by financial ratios (e.g. earnings-to-price ratio, book-to-market ratio, and dividend-to-price ratio) by splitting financial ratios into two components: cyclical components and stochastic trend components. They find that the cyclical components predict increases in future stock returns, whilst the stochastic trend components predict declines in future stock returns, while Pietrovite (2009) confirms that managers use the information contained in the P/E ratios to make investment decisions.

Hypotheses Development

The following questions motivate our analysis. First, do earnings-to-price ratios exhibit a time-trend convergence pattern? Recent trends in world financial markets suggest this possibility. The removal of barriers between capital markets in the case of the EU area and movements towards international harmonization of accounting standards (through the adoption of International Accounting Standards-IAS regime) may contribute to market convergence. If the sources of systematic risk are common and are priced internationally, it would follow that earnings-to-price ratios for similar firms would be the same on a global basis because the growth opportunities would be priced in a more homogeneous manner across these markets.

Next, if there is a time trend convergence pattern for earnings to price ratios, are there factors that drive this convergence? One factor of interest is market efficiency, as proxied by variance ratios. This study assesses the relative differences in efficiency at the market level across equity markets. Measuring whether efficiency holds is a crucial matter because pricing drives capital allocation in equity markets. Markets where share prices slowly incorporate information are less efficient than markets where share prices rapidly incorporate all available information. In other words, efficiency testing implies the degree to which equity market returns follow a random walk process. The methodology of testing for efficiency, recommended by Lo and MacKinlay (1988) and Campbell *et al.* (1997), is based on variance ratios that study autocorrelations in such returns. To this end, the association between earnings-price ratios and efficiency is extremely crucial, since it indicates how investors react to new information, especially earnings' information (Kryzanowski and Zhang, 1992; Chan *et al.*, 1996; Bartholdy, 1998).

Ferson and Harvey (1991) demonstrate that predictability may be driven by time-varying risk premiums instead of market inefficiency. Thus, it is not possible to distinguish between high variance ratios due to market inefficiency and those due to time-varying risk premiums. However, very low variance ratios would be evidence that markets are efficient, since time-varying risk premiums would only increase the predictability of returns.

In addition to efficiency and variance ratios, another factor that has been described as driving convergence is the harmonization of accounting practices on a worldwide basis. This harmonization practices imply that accounting variables are being measured similarly and, thus, any such convergence is expected to lead to a similar convergence in the earnings-to-price ratios. Ball *et al*. (2000) argue that there are systematic differences in accounting incomes as well as in accounting systems on an international basis, while Choi and Meek (2005) report that the International Accounting Standard Board has issued IAS that are closely compatible with accounting standards applied to countries, such as the U.S. and the U.K.

DATA AND METHODOLOGY

The data used in this study are quarterly earnings-to-price ratios, consumer prices, proxied by the consumer price index, industrial production, short- and long-term interest rates, proxied by the 3-month T-Bill rate and the 10-year Treasury bond yield, respectively, market capitalization, and dividend yields for 19 EU markets spanning the period 1994:q1-2012:q2. We compute the real interest rate as the nominal rate minus the quarterly consumer price realized inflation. Market capitalization is expressed in terms of national currency. We did not convert market capitalization to the same currency in order to avoid introducing the stochastic properties of the exchange rates into the original series. To be able to compare different market capitalization series, we divided all the observations by the first observation and then multiplied all observations by a factor of 100. In other words, market capitalization is expressed as an indicator.

Although the process of international financial convergence was initiated in 1980 (Gultekin *et al*. 1989; Mittoo, 1992; Karolyi and Stulz, 2002), our empiricasl analysis begins at 1994 due to data availability for all countries under investigation. These 19 markets are selected due to data availability for earnings. Earnings-to-price ratios, market capitalization and dividend yields come from the Datastream's value weighted total market index and, naturally, obtained from Datastream. Daily series of the Datastream's market index are used to construct quarterly measures of market efficiency, described later. Consumer prices and industrial production are collected from the International Financial Statistics database, except for those on consumer price index for Germany obtained from the OECD National Accounts database. Finally, data on short-term interest rates are obtained from the OECD Economic Outlook, while those on long-term interest rates are obtained from Oxford Economics. For Cyprus no interest rate time series data are available, and, thus, the country was not included in the interest rate section of convergence.

Phillips and Sul (2007) propose a new econometric approach for testing the convergence hypothesis. Their method is based on a nonlinear time varying factor model and provides the framework for modeling transitional dynamics as well as long-run behavior. This section describes the econometric methodology for testing convergence for identifying convergence clubs. The new methodology is based on the following time varying common factor representation for y_{it} of economy (country) i:

$$y_{it} = \delta_{it}\mu_t, \tag{1}$$

where μ_t is a single common component and δ_{it} is a time varying idiosyncratic element, which captures the deviation of economy i from the common path which is defined as μ_t. Within this framework, all N economies will converge, at some point in the future, to the steady state if $\lim_{k\to\infty}\delta_{it+k} = \delta$ for all i=1,2,…,N, irrespective of whether they are near the steady state or in transition. This is of major importance since paths to the steady state (or states) across economies can differ significantly. Moreover, the data sets available to empirical researchers most likely contain transition periods as well as periods near the steady state. Since δ_{it} cannot be directly estimated from (1) due to over-parametrization, Phillips and Sul (2007, 2003) eliminate the common component μ_t through the rescaling by the panel average:

$$h_{it} = \frac{y_{it}}{\frac{1}{N}\sum_{j=1}^{N} y_{jt}} = \frac{\delta_{it}}{\frac{1}{N}\sum_{j=1}^{N}\delta_{jt}}, \tag{2}$$

The relative measure h_{it} captures the transition path, but with respect to the panel average. In order to define a formal econometric test of convergence as well as an empirical algorithm of defining club convergence, the authors assume the following semiparametric form for the time varying coefficients δ_{it} **:**

$\delta_{it} = \delta_i + \sigma_{it}\xi_{it}$, where $\sigma_{it} = \frac{\sigma_i}{L(t)t^{\alpha}}$, $\sigma_i > 0$, $t \geq 0$, and ξ_{it} is weakly dependent over t, but iid(0,1) over i**.** The function $L(t)$ is a slowly varying function, increasing and divergent at infinity.

In this paper we set $L(t) = \log(t+1)$ (3)

Under this specific form for δ_{it},

the null hypothesis of convergence for all i, takes the form: $H_0: \quad \delta_i = \delta, \quad \alpha \geq 0$, while the alternative hypothesis of no convergence for some i, is expressed as: $H_A: \quad \delta_i \neq \delta \quad or \quad \alpha < 0$. Phillips and Sul (2007) show that the null of convergence can be tested in the framework of the following regression (the analytic proof that under the convergence hypothesis this regression equation holds is reported in Appendix B of Phillips and Sul, 2007):

$$\log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = \hat{c} + \hat{b}\log t + \hat{u}_t, \tag{4}$$

for $t = [rT], [rT]+1, ..., T$, and $r > 0$**.** Following Phillips and Sul (2007), the methodology selects r in [0, .. ,3]. Then, this r is the value multiplied by T to truncate the data sample.

In this regression, $H_t = \frac{1}{N}\sum_{i=1}^{N}(h_{it} - 1)^2$ (5)

and

$$\hat{b} = 2\hat{\alpha} \tag{6}$$

where h_{it} is defined in (2) and $\hat{\alpha}$ is the least squares estimate of α. Under the null hypothesis of convergence, the dependent variable diverges whether $\alpha > 0$ or $\alpha = 0$, thus the convergence hypothesis can be tested by a t test of the inequality null $\alpha \geq 0$. The t-test statistic $t_{\hat{b}} = \frac{\hat{b}}{s_{\hat{b}}}$ (7)

follows asymptotically the standard normal distribution and it can be constructed using a heteroskedasticity and autocorrelation consistent (HAC) standard error.

Following Phillips and Sul, we estimate standard errors by

$$s_{\hat{b}} = l\hat{\text{var}}_r(\hat{u}_t)\left[\sum_{t=[Tr]}^{T}\left(\log t - \frac{1}{T-[Tr]+1}\sum_{t=[Tr]}^{T}\log t\right)^2\right]^{-1} \tag{8}$$

where $\hat{l}\,\widehat{\text{var}}(\hat{u}_t)$ is the estimated HAC long-run variance of the regression residuals. At the 5% level we reject the null hypothesis of convergence is logt < - 1.65. Phillips and Sul (2007) call the one sided t test, which is based on $t_{\hat{b}}$, the $\log t$ test due to the presence of the logt regressor. The logt test has good asymptotic and finite sample properties and it is easy to be implemented.

One important issue in the empirical convergence literature is the possible existence of multiple equilibria. In such a case, rejection of the null hypothesis that all economies in the sample are under convergence does not imply the absence of different convergence clubs in the panel. In our study we implement the "Club Convergence and Clustering" procedure proposed by Phillips and Sul (2007). The procedure is summarized in the following steps: First, order the N economies according to the value of the final times series. Second, form all possible core groups C_k by selecting the first k highest economies, with $k = 2,3,...N$. Test for convergence using the $\log t_k$ test within each subgroup of size k. Define the core group C^* of size k^* as the group for which the maximum $\log t_{k^*}$ statistic is computed, given of course that all $\log t_k$ statistics over which the maximization is performed support the convergence hypothesis. Third, find all the economies that according to the logt test converge to the same steady state with the core group C^*. This identifies the first convergence club in the panel. For the remaining economies (if any) the procedure is repeated in order to determine the next convergence club, if one exists. We stop when the remaining economies fail to converge, i.e. according to the logt test, they form a club.

RESULTS

Tables 1 and 2 present summary statistics on the mean and standard deviation of inflation, dividend yields, industrial production, long-term interest rates and market capitalization, P/E ratios, stock prices and short-term interest rates, respectively. Means are calculated as the average of the quarterly values for each quarter.

Table 3 reports the results of the panel convergence methodology for the earnings-price ratios. The table involves three columns. The first column reports the results of the full convergence *logt* test, i.e., convergence among all sample countries. As the first column in this table indicates, the null hypothesis of full convergence is rejected at the 5% level. Specifically, the point estimate of the t-value is -1.660. These findings imply the absence of a converging behavior in the earnings-price ratios in all 19 EU countries.

Given the absence of full convergence, we proceed with implementing the club clustering algorithm to identify subgroups of countries that satisfy the convergence criterion (hereafter, the terms group and club are used interchangeably). The results are reported in columns two through three. As these findings indicate, one convergent club is formed by Austria, Cyprus, Czech Republic, Finland, France, Greece, Hungary, Italy, Luxembourg, Poland, Portugal, Spain, Sweden and the UK, while the second group involves Belgium, Germany, Ireland and the Netherlands. Finally, Denmark displays an independent (non-converging) behavior. The lack of full convergence of the earnings-price ratios, and more importantly, the formation of two convergent clubs, calls for the investigation of possible factors responsible for such lack of convergence.

Table 1: Summary Statistics Part 1

Countries	Mean	Min	Max	Standard Deviation	Mean	Min	Max	Standard Deviation
	Panel A: Inflation				**Panel B: Dividend Yields**			
Austria	0.019	0.000	0.037	0.009	2.055	0.930	5.510	0.817
Belgium	0.020	-0.012	0.054	0.011	3.168	1.440	11.420	1.811
Cyprus	0.027	-0.010	0.053	0.011	8.662	0.580	41.560	10.393
Czech Rep.	0.040	-0.004	0.126	0.032	3.921	0.630	9.110	2.155
Denmark	0.021	0.009	0.041	0.006	1.553	0.900	3.090	0.407
Finland	0.016	-0.010	0.045	0.012	2.946	0.690	7.440	1.378
`France	0.016	- 0.005	0.033	0.007	2.793	1.280	5.810	1.030
Germany	0.040	0.006	0.096	0.019	2.588	1.140	6.460	1.096
Greece	0.090	0.024	0.265	0.063	2.739	1.260	6.410	1.060
Hungary	0.025	-0.063	0.064	0.025	2.524	1.060	7.390	1.279
Ireland	0.024	0.001	0.055	0.010	3.445	1.480	10.090	1.375
Italy	0.021	-0.002	0.042	0.009	2.295	1.150	4.040	0.685
Luxembourg	0.021	-0.001	0.042	0.009	2.827	1.330	7.860	1.127
Netherlands	0.021	0.003	0.043	0.008	2.446	0.480	6.070	1.201
Poland	0.068	0.003	0.286	0.066	2.798	0.320	8.270	1.544
Portugal	0.027	-0.015	0.048	0.012	3.066	1.050	6.959	1.414
Spain	0.028	-0.011	0.051	0.012	2.884	1.240	6.090	0.950
Sweden	0.013	-0.014	0.042	0.012	2.901	1.400	5.230	0.811
UK	0.021	0.005	0.048	0.010	3.611	2.720	4.090	0.421
	Panel C: Industrial Production				**Panel D: Long Term Interest Rates**			
Austria	90.600	57.600	123.800	18.985	4.651	1.840	7.680	1.273
Belgium	92.001	61.300	125.200	17.222	4.838	2.900	8.340	1.248
Cyprus	92.919	77.500	111.100	8.501	------	-----	-----	------
Czech Rep.	93.219	64.900	129.000	20.149	6.733	2.560	19.670	3.953
Denmark	94.774	76.200	111.600	8.639	4.762	1.200	8.760	1.647
Finland	90.814	57.400	118.500	16.075	4.861	1.850	10.350	1.844
France	95.364	84.500	102.600	5.401	4.665	2.200	8.260	1.345
Germany	98.785	80.600	124.300	11.594	4.447	1.400	7.570	1.375
Greece	90.980	71.541	106.361	9.038	8.051	3.410	31.740	5.689
Hungary	83.288	39.200	128.900	26.284	9.324	6.180	14.450	2.777
Ireland	81.171	29.700	112.900	26.912	5.597	1.970	10.800	1.791
Italy	97.732	77.000	109.800	8.493	5.748	3.390	12.740	2.398
Luxembourg	85.225	61.900	105.700	12.476	4.486	1.770	7.850	1.478
Netherlands	96.195	73.100	120.200	10.915	4.548	1.750	7.560	1.274
Poland	91.862	46.000	151.900	29.463	10.689	4.740	28.450	6.620
Portugal	99.479	78.100	113.000	8.369	6.147	3.330	13.470	2.727
Spain	91.867	75.400	106.800	8.825	5.538	3.180	11.910	2.182
Sweden	91.829	65.400	116.200	11.949	5.045	1.380	11.110	2.260
UK	97.714	88.000	103.600	4.466	5.417	3.960	7.680	1.200

Notes: The table reports basic statistics, i.e. mean, min, max and standard deviation for a number of macroeconomic and financial variables, i.e. inflation, dividend yields, industrial production, and long-term interest rates.

This part of the paper attempts to examine the convergence or divergence pattern of certain variables influencing the behavior of the earnings-price ratios. According to Kumar and Hyodo (2001), certain factors can be used to explain price-earnings ratios patterns, which include economic factors related to the macroeconomic environment, i.e. inflation, industrial production and interest rates, differences in accounting rules and differences in market efficiency. One of those economic variables is the market capitalization (Table 4), which is used as a proxy for the size of a market. The reason is that smaller markets are considered to offer greater opportunities for growth. By contrast, the small size of such markets may be an indication of their inability to grow or their possession of high risk.

Table 4 reports the results of the panel convergence methodology for market capitalization. The table involves four columns. As the first column indicates, the null hypothesis of full convergence is rejected at any reasonable significance level. Specifically, the point estimate of the t-value is -19.773. These findings imply the absence of a converging behavior in the earnings-price ratios in all 19 EU countries. The results also report that three distinctive clubs are formed, with the results providing empirical support to those

displayed in Table 3 and indicating the absence of full convergence. In other words, the results imply that the market size is a factor giving rise to a divergent behavior.

Table 2: Summary Statistics Part 2

Countries	Mean	Min	Max	Standard Deviation	Mean	Min	Max	Standard Deviation
	Panel A: Market Capitalization				**Panel B: PE Ratio**			
Austria	5,5567	15,145	155,556	39,868	16.212	6.000	32.100	4.896
Belgium	149,455	45,641	268,368	76,600	14.293	5.200	25.100	3.985
Cyprus	5,567	826	19,482	4,680	13.941	0.600	39.500	10.368
Czech Rep.	601,138	127,724	1,397,984	316,440	15.430	7.600	32.000	5.368
Denmark	701,654	1,99,132	1,308,502	311,221	18.624	8.900	33.000	4.578
Finland	133,406	18,605	359,082	79,455	17.401	6.600	71.400	11.509
France	1,008,026	253,360	1,928,818	454,231	15.546	8.000	25.400	3.629
Germany	834,159	288,704	1,384,551	300,134	16.031	9.100	26.800	4.063
Greece	61,545	4,914	157,963	39,939	16.816	7.300	36.300	6.395
Hungary	3,851,204	74,020	8,932,417	2,422,041	15.038	7.100	29.100	4.350
Ireland	56,778.3	13,127	123,325	27,969	14.674	4.000	26.200	4.361
Italy	459,087	104,243	803,866	207,311	17.523	6.400	32.500	5.290
Luxembourg	19,810	4,638	37,183	9,336	17.091	4.300	32.900	6.875
Netherlands	425,507	166,575	754,968	491,951	16.605	5.400	31.900	5.620
Poland	176,044	5,594	491,950	151,451	15.503	6.600	27.900	5.464
Portugal	51,439	9,248	99,567	21,741	17.746	4.400	40.200	6.607
Spain	373,586	82,474	746,106	184,162	15.565	7.200	25.600	4.655
Sweden	2,163,947	552,425	3,786,593	922,590	17.093	7.500	31.200	5.467
UK	1,379,103	549,087	2,003,365	420,123	15.884	7.100	26.700	3.988
	Panel C: Stock Price Index				**Panel D: Short Term Interest Rates**			
Austria	1,339.158	600.940	3,292.150	776.838	3.066	0.660	5.830	1.347
Belgium	2,626.552	935.030	5,079.450	1,089.817	3.143	0.660	6.810	1.455
Cyprus	582.094	82.71	2,344.090	473.981	----	----	----	----
Czech Rep.	325.611	74.460	828.590	253.569	5.598	0.980	19.670	4.678
Denmark	5,173.997	1,444.970	10,614.110	2,606.701	3.551	0.380	6.860	1.601
Finland	737.916	122,520	1,666.090	406.262	3.266	0.660	7.580	1.609
France	5,612.773	1,847.870	10,315.700	2,326.292	3.155	0.660	6.050	1.456
Germany	1,383.937	580.560	2,323.540	483.084	3.067	0.660	5.830	1.347
Greece	1,153.445	268.700	2,555.86	651.238	6.103	0.660	20.000	5.322
Hungary	1,120.097	122.280	2,633.13	699.931	12.366	5.290	23.450	6.256
Ireland	8,180.751	2,486.510	17,781.750	3,786.668	4.108	0.660	11.010	2.787
Italy	4,529.861	1,772.150	8,205.560	1,726.834	3.038	0.66	5.280	1.328
Luxembourg	512.284	192.500	960.080	215.878	3.104	0.437	6.520	1.421
Netherlands	3,737.393	1,283.640	6,400.900	1,332.423	2.997	0.385	5.283	1.362
Poland	125.213	28.130	284.420	65.179	4.043	0.660	13.630	2.867
Portugal	257.083	94.010	507.350	97.454	3.780	0.660	9.320	2.306
Spain	622.820	158.400	1,212.86	286.957	3.823	0.480	9.170	2.061
Sweden	3,415.055	878.070	6,563.210	1,684.232	4.563	0.590	7.580	2.069
UK	19,908.790	8,117.490	32,136.890	6,803.258	4.833	0.660	7.000	1.823

Notes: The table reports basic statistics, i.e. mean, min, max and standard deviation for a number of financial variables, i.e. market capitalization, the P/E ratio, stock prices, and short-term interest rates.

Table 3. Club Convergence – Earnings-Price Ratios

All Countries	First Convergence Club	Second Convergence Club	Not Converging Countries
Austria	Austria	Belgium	Denmark
Belgium	Cyprus	Germany	
Cyprus	Czech	Ireland	
Czech Rep.	Finland	Netherlands	
Denmark	France		
Finland	Greece		
France	Hungary		
Germany	Italy		
Greece	Luxembourg		
Hungary	Poland		
Ireland	Portugal		
Italy	Spain		
Luxembourg	Sweden		
Netherlands	UK		
Poland			
Portugal			
Spain			
Sweden			
UK			
logt = -1.660*	logt = -0.527***	logt = 7.601***	

*Notes: The first column reports the results of the full convergence logt test, i.e., convergence across all sample countries. The results from implementing the club clustering algorithm are reported in columns two and three, while the last column reports the non-diverging country group. ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively.*

Table 4. Club Convergence – Market Capitalization

All Countries	First Convergence Club	Second Convergence Club	Third Convergence Club	Not Converging Countries
Austria	Austria	Belgium	Germany	Netherlands
Belgium	Hungary	Cyprus	UK	
Cyprus	Poland	Czech Rep.		
Czech Rep.		Denmark		
Denmark		Finland		
Finland		France		
France		Greece		
Germany		Ireland		
Greece		Italy		
Hungary		Luxembourg		
Ireland		Portugal		
Italy		Spain		
Luxembourg		Sweden		
Netherlands				
Poland				
Portugal				
Spain				
Sweden				
UK				
logt = -19.733	logt = 2.123***	logt = 2.519***	logt = 2.134***	

*Notes: The first column reports the results of the full convergence logt test, i.e., convergence across all sample countries. The results from implementing the club clustering algorithm are reported in columns two to four. The last column reports the non-converging club. *** indicates significance at the 1 percent level.*

Next, we repeat the analysis by separating our full sample into a small markets group and a large markets group in terms of market capitalization. The median of such capitalization is the criterion for dividing all capital markets under study as small or large capital markets. The results are reported in Table 5.

The null hypothesis of full convergence is rejected at the 5% level in both sizes. For large capitalization countries (Panel A), the countries under examination belong exactly to two convergence clubs. In particular, the point estimate of *logt* t-statistic over the relevant period is -51.75, which rejects the full convergence hypothesis. The first club includes Spain and Sweden and the second club includes Belgium, France,

Germany, Italy and the UK, while the Netherlands displays a non-converging behavior. In terms of the small capitalization countries (Panel B), the results also point out to an overall diverging pattern, since the *logt* t-statistic is -10.681, which strongly rejects the convergence hypothesis. The analysis in this group reveals the presence of two clubs. More specifically, the first club includes Austria, Hungary and Poland, while the second club includes Cyprus, Czech Republic, Greece, Ireland, Luxemburg and Portugal. The results imply that the market size is definitely a factor giving rise to a divergent behavior.

Table 5. Club Convergence – Market Capitalization: Large vs Small Capitalization Countries

Panel A: Large Capitalization Countries				**Panel B: Small Capitalization Countries**			
Countries	**First Convergence Club**	**Second Convergence Club**	**Not Converging Countries**	**Countries**	**First Convergence Club**	**Second Convergence Club**	**Not Converging Countries**
Belgium	Spain	Belgium	Netherlands	Austria	Austria	Cyprus	
France	Sweden	France		Cyprus	Hungary	Czech rep.	
Germany		Germany		Czech Rep.	Poland	Greece	
Italy		Italy		Denmark		Ireland	
Netherlands		UK		Finland		Luxembourg	
Spain				Greece		Portugal	
Sweden				Hungary			
UK				Ireland			
				Luxembourg			
				Poland			
				Portugal			
logt = -51.75	logt = 1.08***	logt = 12.62***		logt = -10.681	logt = 1.31***	logt = 9.64***	

*Notes: Panel A reports the market capitalization convergence results across the large capitalized countries, while Panel B repeats the analysis for the small capitalized countries. The first column of each panel reports the results of the full convergence logt test, i.e., convergence across all sample countries, while the results from implementing the club clustering algorithm are reported in columns two to three in each panel. Finally, column four in each panel reports the non-converging club. *** indicates significance at the 1 percent levels.*

Next, three macroeconomic variables are examined: inflation, industrial production, and the real interest rate. According to Lamont (1998), earnings contain information about returns that is not contained in other variables. Because earnings are correlated with business conditions, earnings have predictive power for returns. Guenther and Young (2000) make a similar argument, claiming that earnings are associated with real economic activity. First, we examine inflation, a factor attributed to the economic environment of the firm. More specifically, Modigliani and Cohn (1979) and French and Poterba (1991) argue that inflation is a source of difference between accounting and economic earnings. The smaller the inflation differences between markets, the smaller their differences in corresponding earnings-price ratios. The results are reported in Panel A of Table 6. As the findings in Panel A of Table 6 indicate, there is a full convergence club for which the point estimate of *logt* t-statistic is 2.419. Only the Netherlands displays a non-converging country behavior, which does not alter the convergence results. These empirical findings are in accordance with the expectations that the formation of the EU (involving also the countries participating in the European Monetary Union area) has acted as a converging propelled mechanism for inflation convergence. Next, we report (Panel B) the industrial production convergence results. Industrial production is used as proxy for real economic activity. For the empirical purposes of this study we make use of the growth rate of industrial production. The findings show that the null hypothesis of full convergence is rejected, since the value of *logt* t-statistic is -90.633. The results of the club clustering procedure identify five converging clubs. These findings document the diverging behavior of the European Southern countries in terms of their real economic activity. In other words, the results point out the different economic structure of EU economies, an argument supporting the view of the asymmetric behavior of EU economies and the recent crisis events.

Table 6. Club Convergence – Inflation and Industrial Production

All Countries	**First Convergence Club**	**Not Converging Countries**
Panel A: Inflation		
Austria	-------	Netherlands
Belgium		
Cyprus		
Czech Rep.		
Denmark		
Finland		
France		
Germany		
Greece		
Hungary		
Ireland		
Italy		
Luxembourg		
Netherlands		
Poland		
Portugal		
Spain		
Sweden		
UK		
logt = 2.419***		

Panel B: Industrial Production					
All Countries	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**	**Fifth Convergence Club**
Austria	Hungary	Austria	Cyprus	France	Greece
Belgium	Ireland	Belgium	Denmark	Portugal	Italy
Cyprus	Poland	Czech Rep.	Germany	Spain	UK
Czech Republic		Finland	Luxembourg		
Denmark			Netherlands		
Finland			Sweden		
France					
Germany					
Greece					
Hungary					
Ireland					
Italy					
Luxembourg					
Netherlands					
Poland					
Portugal					
Spain					
Sweden					
UK					
logt=-90.63	logt=5.764***	logt=7.970***	logt=4.394***	logt=6.38***	logt=0.923***

*Panel A in this table reports the results for inflation. The first column reports the results of the full convergence logt test, i.e., convergence across all sample countries, while column 3 reports the non-converging club results. Panel B reports the results for the definition of industrial production. The first column reports the results of the full convergence logt test, i.e., convergence across all sample countries, while the results from implementing the club clustering algorithm are reported in columns 2 to 6. *** indicates significance at the 1 per cent.*

The final factor capturing the impact of the macroeconomic environment is real interest rates. A number of studies document a significant diverging behavior in real interest rates across countries over time (Mishkin, 1984; Darby, 1986; Chowdhry and Titman, 2001). Frankel (1991) and Chowdhry and Titman (1991) have discussed the potential association between real interest rates and earnings-price ratios across countries. The principal mechanism that governs such an association is the impact of real interest rates on the productivity of traded goods. In particular, changes in productivity lead to changes in the cost of producing capital goods and, thus, to changes in their prices. The latter affect investors' behavior and consequently the rental rate of such capital. However, the price to rental ratio is fundamentally the same as the price-earnings ratio, and thus, we can document the association between real interest rates and price-earnings ratios. Moreover, industries involved in the production of capital goods usually make use of either labor-intensive production patterns or capital-intensive production technology, implying an additional

mechanism that explains the above association. Table 7 reports the results of the formal convergence test obtained from the clustering algorithm for the interest rates. Full convergence is strongly rejected for both short- (Panel A) and long-term (Panel B) interest rates, since the logt statistic takes the values of -3.178 and -5.125, respectively. Moreover, the application of the club convergence procedure on short-term interest rates indicates the presence of four convergence clubs, while two countries in our sample, namely, Denmark and Hungary, fail to converge to any of these clubs, i.e. they form a distinctive club. In terms of long-run interest rates, the results indicate the presence of three convergence clubs.

Table 7. Club Convergence – Real Interest Rates

All Countries	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**	**Not Converging Countries club**
Panel A: Short-term Real Interest Rates					
Austria	Greece	Czech Rep.	Ireland	Austria	Denmark
Belgium	Sweden	Italy	Poland	Belgium	Hungary
Czech Rep.		Portugal		Finland	
Denmark		Spain		France	
Finland		UK		Germany	
France				Luxembourg	
Germany				Netherlands	
Greece					
Hungary					
Ireland					
Italy					
Luxembourg					
Netherlands					
Poland					
Portugal					
Spain					
Sweden					
UK					
logt = -3.178	logt = -1.539**	logt = 1.536***	logt = -0.933***	logt = 1.529***	logt = -6.779

Panel B: Long-Term Real Interest Rates			
All countries	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**
Austria	Greece	Hungary	Austria
Belgium	Poland	Ireland	Belgium
Cyprus	Portugal		Czech Republic
Czech Republic			Denmark
Denmark			Finland
Finland			France
France			Germany
Germany			Italy
Greece			Luxembourg
Hungary			Netherlands
Ireland			Sweden
Italy			UK
Luxembourg			
Netherlands			
Poland			
Portugal			
Spain			
Sweden			
UK			
Logt = -5.125	Logt = 0.647***	Logt = 1.663***	Logt = -1.598**

Notes: Panel A in this table reports the results for the short-term real interest rates. The first column reports the results of the full convergence logt test, i.e., convergence across all sample countries. The results from implementing the club clustering algorithm are reported in columns 2 to 5, while column 6 reports the non-converging club results. Panel B reports the results for the long-term real interest rates. The first column reports the results of the full convergence *logt* test, i.e., convergence across all sample countries. The results from implementing the club clustering algorithm are reported in columns 2 to 4. *** and ** indicate significance at the 1 and 5 per cent, respectively.

Finally, we turn to dividend yields, which we use as a proxy for the convergence of accounting standards. These yields are closely linked to the firm's cost of capital. In terms of convergence, changes in dividend yields should be a reliable measure of changes in the extent of convergence, while lower dividend yields

imply stronger convergent markets. Bekaert and Harvey (2000) measure the impact of liberalization on financial market convergence by examining the role of the cost of equity capital. According to them, dividend yields capture the permanent price effects following changes in the cost of capital much better than noisy returns can. As a result, dividend yields decline after liberalizations. Land and Lang (2002) claim that dividends are the cash resources paid out to stockholders. If earnings change, say, due to changes in accounting practices, then changes in earnings are very unlikely to be associated with changes in dividends (Aron, 1991; French and Poterba, 1991). While stock prices are computed as discounted future flows of dividends, it is highly likely that dividend yields could change along with earnings-price ratios due to changes in accounting practices. By contrast, La Porta *et al.* (2000) document dividends are low in countries where legal systems do not strongly protect minority shareholders from inside expropriation. Given the high heterogeneity of such relevant institutional factors around the globe, dividends are not expected to act as potential proxies for financial, i.e., earnings-price ratios, convergence. Only by opting into more protective legal regimes or radically changing the legal environment could higher convergence processes be generated.

Results from the formal econometric convergence tests are reported in Table 8 (Panel A), which show that the null hypothesis of full convergence is accepted for the time period under consideration, since the value of *logt* t-statistic is 14.018. These findings document a strong convergence pattern in accounting practices.

Table 8. Club Convergence – Dividend Yields and Market Efficiency

Panel A: Dividend Yields			**Panel B: Market Efficiency**		
All Countries	**First Convergence Club**	**Not Converging Countries**	**All Countries**	**First Convergence Club**	**Not Converging Countries**
Austria	---------	----------	Austria	Austria	Czech Rep.
Belgium			Belgium	Belgium	Portugal
Cyprus			Cyprus	Cyprus	
Czech Rep.			Czech Rep.	Denmark	
Denmark			Denmark	Finland	
Finland			Finland	France	
France			France	Germany	
Germany			Germany	Greece	
Greece			Greece	Hungary	
Hungary			Hungary	Ireland	
Ireland			Ireland	Italy	
Italy			Italy	Luxembourg	
Luxembourg			Luxembourg	Netherlands	
Netherlands			Netherlands	Poland	
Poland			Poland	Spain	
Portugal			Portugal	Sweden	
Spain			Spain	UK	
Sweden			Sweden		
UK			UK		
logt = 14.018***			logt = -20.219	logt = 5.818***	logt = -7.454

*Notes: Panel A in this table reports the results for dividend yields. The first column reports the results of the full convergence logt test, i.e., convergence across all sample countries, while Panel B reports the results for the definition of market efficiency. The first column reports the results of the full convergence logt test, i.e., convergence across all sample countries, while the results from implementing the club clustering algorithm are reported in column 2. Finally, column 3 reports the non-converging club results. *** indicates significance at the 1 per cent.*

In addition, the final factor examined in this paper is market efficiency in its weak form. In particular, if prices follow a random walk (RW) pattern, then returns turn out to be described as IID processes and the variance of q-period returns equals q times the variance of the one-period returns. Following Lo and MacKinlay (1988) and Campbell *et al.* (1997), we define a measure of relative efficiency based on variance ratios (VRs). Under the RW hypothesis, VRs should be equal to one. By contrast, in an inefficient market VRs ratios are above unity if returns are positively correlated and below unity in the case returns exhibit negative autocorrelations. We call our measure of efficiency the absolute variance ratio (AVR), which is defined as:

$$AVR_t = \left| \frac{\widetilde{\sigma}_t(q)}{\widetilde{\sigma}_t(1)} - 1 \right|,$$

where the index t refers to the quarter t and $\widetilde{\sigma}_t(q)$ is the sample variance of the q-period holding returns calculated using daily returns in the quarter t. In the present paper we set q=5. We also perform the analysis for q=2, 3, and 4. The results are qualitatively similar to those presented here and are available from the authors upon request. Table 8 (Panel B) reports that the logt statistic takes the value of -20.219, which rejects the null hypothesis of full convergence. However, we do have the presence of a single club, while two countries, i.e. the Czech Republic and Portugal form a non-converging group. In other words, we can potentially claim that the EU countries form virtually a single club in terms of their market efficiency issue.

CONCLUDING COMMENTS

This paper tested for earnings-price ratios convergence among 19 EU countries over the period 1994:q1-2012:q2 and attempted to explain the contribution of certain economic and accounting factors, such as inflation, market capitalization, dividend yields, stock prices, short- and long-term interest rates, industrial production and a measure of market efficiency in the countries' converging or non-converging behavior. To serve both objectives, the novel methodology of Phillips and Sul (2007) has been used. This methodology used a non-linear factor model with a common and an idiosyncratic component – both time-varying, which allows for technical progress heterogeneity across countries.

The empirical findings suggested that the countries in our sample did not form a homogeneous convergence club in terms of their earnings-price ratios, but their convergence patterns varied across markets, a fact that was mainly attributed to inter-country differences in economic factors affecting the behavior of earnings-price ratios. In particular, EU countries were characterized by different economic conditions, such as growth opportunities or business cycles synchronizations.

The implications of our findings are that for a country or a group of countries which do not follow the convergence pattern, more coordinated growth strategies are required to facilitate a stronger capital market convergence process. Furthermore, the implications seem crucial for policy makers as well once they are concerned with the impact of the convergence issue on capital flows and the volatility of financial aggregates. Finally, potential avenues for further research will be the consideration of a sample of countries that includes more developed as well as emerging capital markets.

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BIOGRAPHY

Dr. Nicholas Apergis is Program Leader, Business School, Northumbria University, Newcastle upon Tyne, UK NE1 8ST. He has over 200 publications in international refereed journals, while he is the Editor of International Journal of Economic Research and of the International Journal of Financial Studies.
Email: napergis@unipi.gr

Dr. Christina Christou is Assistant Professor in Econometrics at the University of Piraeus, Greece. She holds a Ph.D in Economics from the University of Cyprus and a Ph.D in Physics and Mathematics from Moscow State University, Lomonosov. She has over 50 publications in international refereed journals. Email: christou@unipi.gr

Dr. Christis Hassapis is Associate Professor of Economics, University of Cyprus. He holds a Ph.D in Economics from Boston College, USA. He has served as an elected member of the Board of the University of Cyprus, member of the Academic council of the Center of Banking and Finance, Assistant Dean for the School of Business and Economics at the University of Cyprus. He has over 50 publications in international refereed journals and in edited books. Email: dr.christis.hassapis@bc.edu

Dr. Steve Johnson, Corresponding Author, is Associate Professor in Finance at Sam Houston State University. He holds a Ph.D. in Finance from the University of Utah. His research areas include corporate finance, international finance, derivatives, and investments. He has publications in international refereed journals. Email: sjj008@shsu.edu