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Dynamic portfolios interdependencies: new evidence from the Athens Stock Exchange

Abstract

This paper examines volatility and error interdependence for portfolios that we created and based on the classification of Timeliness of Earnings regression on stock price returns. Data comprises 124 Greek companies from ASE (Athens Stock Exchange). This classification contains three portfolios of equities, the 18 highest, 36 middle and 70 smallest stocks, according to the R-squared values. We also compare the interdependence of the above portfolios with three original portfolio indices made by ASE authorities. We use two econometric approaches; a martingale one for the return equation and a nested one for the variance equation of the GARCH-BEKK model.

We find that portfolios made by Timeliness of Earnings metric (created) are more 'error spillover' oriented with the martingale approach and more 'volatility spillover' oriented with the nested approach. In addition, the original portfolio indices give similar results with the two econometric approaches, however small differences do exist. In particular, we find that the original portfolios of equities are more 'volatility oriented' with the martingale approach. Thus, diversifying and focussing on Timeliness of Earnings portfolios, investors can make profits, if they follow an effective and alternative strategy with economic and financial potentiality for them. Finally, in ASE for different portfolios and methodologies both volatility and noise play substantial role in the process of integration and influence the decision of investors.

Keywords: interdependencies, portfolio risk analysis, GARCH-BEKK, Athens Stock Market.
JEL Classification: G15, G11, G32.

Introduction

As Timeliness of Earnings measures how quickly news (symmetric or asymmetric) of stock price returns is recognized in firms' accounts (Ball and Brown, 1968; Jackson et al., 2011), someone could ask the question whether or not the Timeliness of Earnings measure might provide useful information to investors, when firms choose the timing of constructing low risk or high return portfolios due to different accounting disclosure items. Based on the above thought, we create − at the Athens Stock Exchange (ASE) − new portfolios of equities (named 'created' portfolios) and we examine and compare their interdependence findings against the respective findings of standard indexes (named 'original' portfolios). This approach is innovative and could attract investors, risk managers and academics who want to gain some benefits from the fluctuations of stock market returns mainly in the short run.

The motivation of this study is twofold. Firstly, we advocate the use of Timeliness of Earnings which is disclosed to construct portfolios and we examine the financial spillovers of such portfolios against more standard indexes. Secondly, this paper combines two areas of finance: the Timeliness of Earnings measure and the interdependence of portfolios of equities. On the one hand, we use the *R*-square values of Timeliness of Earnings measure in order to construct the 'created' portfolios. On the other hand, we measure the interdependence of the above portfolios with two approaches; a martingale and one nested on the GARCH-BEKK model. These approaches examine, also, the interdependence of the 'original' portfolios which are used as a benchmark for comparison. A martingale approach considers a non-linear constant drift which reflects the initial coefficients of an OLS model. On the contrary, the nested approach analyzes a positive feedback trading and an autocorrelation behavior of investors together.

Overall, we find that for different methodologies and different portfolios which are based either on Timeliness of Earnings measure or not both volatility and noise play substantial roles in the process of integration. This could influence the decision of investors when the news of stock prices is incorporated in accounting reports that are disclosed by firms. In particular, using the martingale approach, we find that the 'original' portfolios of equities are more 'volatility oriented' whereas the nested approach proves to be equally 'volatility spillover' and 'error spillover' oriented. Concerning the martingale approach, we find that 'created' portfolios are more 'error spillover' oriented and with the nested approach we find them more 'volatility spillover' oriented.

This means that integration among 'created' portfolios of equities is influenced by how Timeliness of Earnings measure is associated with the magnitude

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of other accounting figures that are released. Thus, while regulation in ASE is similar for all stocks, the market is efficient only when all news arrives to investors at the same time. In particular, stock market integration, regardless of being volatility or error, will help investors or risk managers to 'create' or to invest on existing portfolios of equities looking at the movements of prices and spillovers effects in ASE for large, medium and small portfolios in order for th market to remain stable.

The rest of the paper is organized as follows. Section 1 presents the existing literature review. Section 2 refers to the econometric models. Section 3 describes the dataset and reports the results and the final section concludes the paper and provides directions of the future research.

1. Literature review

Timeliness of Earnings is an important factor together with the recognition of symmetric or asymmetric stock price returns on the firm's accounts (Jackson et al., 2011; Karivali, Koulakiotis and Papasyriopoulos, 2009). This helps towards the construction of different portfolios as investors' decisions might be influenced by these accounting disclosure figures.

Christodoulou, Grambovas and McLeay (2007) have analyzed the asymmetric timeliness of stock price returns on earnings in order to evaluate companies' stability in the stock market. Other authors (Basu, 1997; Taylor and Taylor, 2003) have combined the existence of conservatism with the asymmetric variation response of earnings to stock price returns. In particular, they explain the faster display of bad news in earnings than of good news. A more recent study (Frankel, Sun and Wang, 2007) looks at the effects of asymmetric timeliness of funds on earnings that are distributed to shareholders.

The measure of Timeliness of Earnings affects the correlation between financial information by published firms. Nevertheless, symmetric or asymmetric stock price returns from different size firms are reported with delay. We expect small equity size portfolios to have a stricter accounting disclosure information report than medium or large equity firms. Thus, accounting earnings should be associated negatively with stock price returns (Jackson et al., 2011; Basu, 1997) and generate different kinds of information from day to day. In this paper, we use the Timeliness of Earnings information that is released through the R-squared metric of a regression in order to examine how rapidly this information is incorporated into stock prices. We construct portfolios of equity returns, looking at the relation between accounting earnings yield and returns, generating three different portfolios sizes based on 124 companies from ASE. We create the CFTSE18, CFTSE36 and CFTSE70 stock portfolios in order to compare their interdependencies (linkages). Next, our intuition is to classify the degree of market integration process (spillovers effects) of 124 equities in ASE. Thus, we consider the three 'original' portfolios of equities, namely OFTSE18, OFTSE36 and OFTSE70 as our benchmark for the three aforementioned 'created' portfolios.

In conjunction with the interdependencies among markets, two types of models have been used by researchers: univariate ones and multivariate ones. Univariate models have been used by Hamao, Masulis and Ng (1990), examining the interrelationships between different world markets and finding strong results. Multivariate models studied the volatility spillovers among markets. For instance, Kanas (2000) studied the relationship between stock returns and exchange rates for six countries, finding asymmetry to play a significant role in the transmission mechanism of five out of six countries worldwide. Additionally, multivariate volatility and error interdependencies among different portfolios of equities have been examined thoroughly by many other researchers. Caporale, Pittis and Spagnolo (2006) used a martingale mean return equation without accounting for short-term dynamics in it. Toyoshima and Hamori (2012) examined the transmission of swap spreads among the US, Japan and UK markets using a cross-correlation function approach without taking into consideration short-term dynamics in the mean return equation. In particular, they used the above variables in order to examine causality-in-mean and causality-in-variance. Their results indicate the existence of more causality-in-variance impact during the period of financial crisis than in the previous normal periods. In the same direction as above, Fu, Holmes and Choi (2011) examined the asymmetric transmission of news between the stock and foreign exchange markets using a GARCH-BEKK model that includes comparable industrial stock returns as a control variable. They found that news shocks in the Japanese currency market explain eight out of ten industrial sectors as far as the transmission of volatility is concerned. They also found evidence of asymmetry in five of the industries examined. In addition, Sakthivel, Bodkhe and Kamaiah (2012) examined correlation and volatility across international stock markets of the USA, India, the UK, Japan and Australia, from January 1998 to July 2011 using a bivariate GARCH model. Their results suggest that there is a bidirectional volatility spillover between the USA and India stock markets. This was due to the fact that there was a common trade and investment behavior between these two economies. Moreover, Kohonen (2012) examined the existence or not of volatility spillovers across national stock markets. He used a system of simultaneous equations for open stock markets, building on recent advances in econometrics and identifying structural vector autoregressive models. In particular, he proposed a way to estimate an existing signal-extraction model for volatility spillovers. He applied this methodology to eurozone stock markets in years 2010-2011 developing a new empirical test for searching of spillovers.

Only Koutmos, Pericli and Trigeorgis (2006) examined both the short-term dynamics and volatility asymmetry in a univariate EGARCH model for the stock market of Cyprus, finding that positive feedback trading plays a significant role in this market. In relation to the short-term dynamics, two possible approaches are significant in literature. These are: (a) the positive feedback trading and (b) the LeBaron's autocorrelation approaches. In particular, Koutmos, Pericli and Trigeorgis (2006) examined three non-linear equations for the conditional mean of the Cyprus stock exchange: (1) the LeBaron (1992) exponential autoregressive model, (2) the Sentana and Wadhwani (1992) positive feedback trading model, and (3) a model that combines both (1) and (2). They modeled the conditional variance as a univariate EGARCH process, linking the second equation of volatility to the first equation of return mean. In other studies, Koutmos (1997a; 1997b) examined the presence of autocorrelation of stock returns in six emerging markets in the Pacific Basin area. He found that there was a positive feedback trading strategy.

Finally, Harris and Pisedtalasai (2006) examined the volatility transmission mechanism between small and large equity portfolios within the UK stock market, finding that negative innovations in one portfolio produced greater volatility spillover in another. Thus, asymmetry is important in the transmission process of a stock market and for this reason we consider in our paper all the different sizes of equities from it.

Similarly, in this paper we examine the spillover mechanism among large, medium and small portfolios of equities, taking into account Timeliness of Earnings measure within the ASE's equities. In addition, we use two different methodologies; the first one is a Martingale-GARCH-BEKK model which consists of a constant term in the mean return equation and for interdependencies in the variance equation. The second one is a Nested-GARCH-BEKK model accounting for short-term dynamics in the mean return equation (based on autocorrelation and positive feedback trading) and interdependencies in the variance equation. Both models investigate the existence of stock market integration.

2. Data and methodology

2.1. Data set. The data used in this study comprises two sets of portfolios for the period from 01/01/1993 to 16/02/2008. The first set of portfolios refers to the 'original' stock equities of OFTSE18, OFTSE36 and OFTSE70 as they are given by the ASE authorities[1]. In particular, the OFTSE18 portfolio contains the first 18 higher in size equities, the OFTSE36 contains the next 36 middle class equities and, last, the OFTSE70 refers to the 70 smaller equities. The second set of portfolios gives the 'created' portfolios of 18 higher (CTSE18), 36 middle (CFTSE36) and 70 smaller (CFTSE70) in size equities, based on *R*-squared metrics of the Timeliness of Earnings regression.

2.2. 'Created' portfolios of equities. This part presents the econometric model that is used for examining the interdependence of three 'created' (e.g. CFTSE18, CFTSE36 and CFTSE70) equity portfolios in ASE, after measuring the degree in earnings disclosure.

Initially, in order to construct the first half of our sample (CFTSE18, CFTSE36, and CFTSE70), we use the regression of Timeliness of Earnings measure on contemporaneous stock price returns based on Basu (1997) study, who measured how quickly the asymmetric information of bad and good news is recognized in the firms' accounts. In our case, we measure Timeliness of Earnings in the same way as Basu (1997) without taking the difference of bad and good news. We are interested in any news regardless of its being asymmetric or not. This regression takes the following form:

$$EPS_{i,t} / P_{i,t-1} = \alpha_0 + \beta_1 R_{i,t} + u_{i,t}, \quad (1)$$

where $EPS_{i,t}$ are the earnings per share, in the period t, namely the earnings of company i, taking into account the quality of accounting reports. $P_{i,t\text{-}1}$ is the annual price of a stock in the period t-1 for company i. $R_{i,t}$ is the annual stock price return for period t for company i. $u_{i,t}$ is the error term in the t period for company i. In addition, we use the R-squared metric of the Timeliness of Earnings yield information measure for stock price returns.

[1] Actually, the standard indexes in ASE are named FTSE 20, FTSE 40 and FTSE 80. Since there was partly unavailable data for the period from 1993 to 2008 we based our original portfolios on 18 out of 20, 36 out of 40 and 70 out 80 equities respectively. Therefore, in this paper the 'original' portfolios of equities include the 18 larger equities of ASE which form the portfolio of OFTSE18, the next 36 equities which form the OFTSE36 portfolio and last the 70 smaller equities which form the OFTSE70 portfolio in terms of the examined time period (see in Tables 7, 8 and 9 the name of the stocks included in this paper).

2.3. Models for the conditional mean. In this part, the multivariate GARCH-BEKK volatility process is defined by the two non linear specifications which are used for the conditional mean equation: (1) the benchmark non-linear martingale model, and (2) a model that combines both (a) the non-linear LeBaron's (1992) autocorrelation exponential autoregressive model and (b) the non-linear Sentana and Wadhwani's (1992) positive feedback trading model. We chose the GARCH-BEKK model to examine the volatility and error transmission among portfolios of different sizes, since these kinds of spillovers affect, substantially and unequally, the stock market integration process in ASE. In contrast, we do not use other methodologies such as EGARCH, as it examines asymmetry, but someone would advance the GARCH-BEKK methodology in order to get this work a step further.

2.3.1. Martingale model. This model assumes that stock price returns ($R_{i,t}$) are affected linearly by its lagged stock price returns. This linear model is written as:

$$R_{i,t} = \alpha_0 + \alpha_1 \sum_{i=1}^{n} R_{i,t-n} + \varepsilon_{i,t}. \quad (2)$$

The expected residuals of the above model are affected by the expected stock price returns and a constant martingale coefficient, which is written as follows:

$$E(\varepsilon_{i,t}) = E(R_{i,t} - \mu_{i,t}), \quad (3)$$

where $R_{i,t}$ is the logarithmic percentage return at time t for index i, e.g. i = 1,2,3 (1 = OFTSE18 or CFTSE18, 2 = OFTSE36 or CFTSE36, 3 = OFTSE70 or CFTSE70), $\mu_{i,t}$ is the long-term drift coefficient for the constant.

Equation (2) indicates that the stock price returns for the three portfolios in ASE can be modeled by an autoregressive (AR) approach. The conditional mean, as it is shown in equation (3), is a function of a martingale process. A statistically significant long drift coefficient ($\mu_{i,t}$) means that a portfolio of stock price returns at time t could be influenced by the same portfolio of stock price returns at time t-1 as is shown in equation (2).

2.3.2. Nested model. The conditional mean of the stock price returns could nest (1) the non-linear LeBaron's (1992) autocorrelation exponential autoregressive model and (2) the non-linear Sentana and Wadhwani's (1992) positive feedback trading model in one, in order to see to which of the two cases (the autocorrelation or the positive feedback trading) we would attribute the behavior of investors to portfolios of different stock market returns:

$$\begin{aligned} R_{i,t} &= \beta_{i,0} + \beta_{i,1}\sigma_{i,t}^2 + \\ &+ (\beta_{i,2} + \beta_{i,3}\sigma_t^2 + \beta_{i,4}\exp\{-\sigma_{i,t}^2\})R_{i,t-1} + \varepsilon_{i,t}. \end{aligned} \quad (4)$$

The above model indicates that volatility might approach zero as the return autocorrelation approaches $(\beta_2 + \beta_4)$. In the event of high volatility values, autocorrelation becomes $(\beta_2 + \beta_3\sigma_t^2)$. Finally, if $\beta_4 = 0$ and $\beta_3 < 0$, then positive feedback trading can drive the time-varying autocorrelation of stock price returns.

2.4. Trivariate GARCH-BEKK approach. Among GARCH models, the trivariate GARCH approach is used widely in time-varying second moments (e.g. covariance) studies. The GARCH-BEKK model successfully overcomes the problems associated with previous approaches, such as the requirement of the definite matrix H_t to be positive, which does not always hold. Previous approaches have examined volatility spillovers, while in this paper we examine volatility and error spillovers without imposing the restriction for the estimated variance to be greater than zero. In addition, the GARCH-BEKK parameterization is specified very well to examine the above spillovers in such a manner that no restrictions are required to ensure a positive definite H_t matrix.

The trivariate GARCH-BEKK model (Engle and Kroner, 1995) for the variance is written:

$$H_t = CC' + B'H_{t-1}B + A'\varepsilon_{t-1} * \varepsilon'_{t-1}A, \quad (5)$$

where H_t is the vector of volatility. A and A' are the usual and the transposed term, respectively ε_t is the error term. C and C' are the constant vector terms, the first the usual one and the second the transposed term. B and B' are the volatility coefficient vectors, the first the usual one and the second the transposed term.

The parameters of the trivariate system are estimated by computing the conditional log-likelihood function for each time period as:

$$L_t(\Theta) = -\log 2\pi - \frac{1}{2}\log|H_t| -$$

$$-\frac{1}{2}E(\varepsilon_{t-1})'(\Theta)H_{t-1}^{-1}(\Theta)E(\varepsilon_{t-1})(\Theta)$$

$$L(\Theta) = \sum_{t=1}^{T} L_t(\Theta), \quad (6)$$

where Θ is the vector of all volatility parameters estimated. Numerical maximization of the log-likelihood function follows the BFGS algorithm and yields the maximum likelihood estimates and associated asymptotic standard errors.

2. Analysis of the dataset and results concerning two specified econometric models

Table 1 presents the basic statistics for the two samples of the 'original' and the 'created' stock portfolios, showing that the mean of stock price returns varies between -0.000018 and 0.00046 for the three 'original' stock portfolios of OFTSE18, OFTSE36 and OFTSE70. The mean of stock price returns of the 'created' stock portfolios (CFTSE18, CFTSE36 and CFTSE70) varies between -0.000066 and 0.00018. In addition, skewness is negative for the two cases of 'original' and 'created' stock portfolios, while kurtosis is statistically significant for both cases and so is the non-normal distribution.

The significance of autocorrelation (LB(12)) and heteroskedasticity (ARCH(4)) presents the two cases of stock portfolios indicating that the GARCH approach could describe the distribution of the study's dataset quite well. Furthermore, the correlation matrix for the two cases shows that the correlation is larger in the 'created' stock portfolios rather than in the 'original' stock portfolios in ASE. In particular, the correlation between the second 'created' stock portfolio and the other two portfolios varies from 0.856 (for CFTSE18 and CFTSE36) to 0.935 (for CFTSE36 and CFTSE70), while the same correlation between the 'original' stock portfolio and the other two portfolios varies from 0.827 (for OFTSE18 and OFTSE36) to 0.909 (for OFTSE36 and OFTSE70). The above results show that the variation in the correlation does not differ much between the two datasets.

Table 1. Sample statistics on daily stock return series for the period from 01/01/93 to 16/02/2008

Panel A: Sample statistics for 'original' portfolios of equities			
Statistics	OFTSE18	OFTSE36	OFTSE70
μ	0.00046	0.00022	-0.000018
σ	0.011	0.013	0.013
S	-0.59	-0.29	-0.58
K	7.32*	5.43*	5.48*
JB	8025.101*	4357.91*	4589.65*
LB(12) for R_t	70.45*	157.23*	154.35*
LB(12) for R_t^2	298.35*	1579.69*	1370.17*
ARCH(4)	38.54*	168.33*	139.16*
Correlation Matrix			
	OFTSE20	OFTSE36	OFTSE70
FTSE18	1	0.82*	0.79*
FTSE36		1	0.90*
FTSE70			1
Panel B: Sample statistics for 'created' portfolios of equities			
Statistics	CFTSE18	CFTSE36	CFTSE70
μ	-0.00006	0.000085	0.00018
σ	0.013	0.012	0.013
S	-0.15	-0.93	-0.48
K	5.280164*	10.20*	5.094*
JB	4078.368281*	15691.22*	3921.38*
LB(12) for R_t	116.17*	112.38*	151.027*
LB(12) for R_t^2	872.62*	334.48*	1625.92*
ARCH(4)	105.32	42.41*	177.74*
Correlation Matrix			
	CFTSE18	CFTSE36	CFTSE70
CFTSE18	1	0.85*	0.88*
CFTSE36		1	0.93*
CFTSE70			1

Notes: * Denotes significance at the 1% level.

Table 2 indicates the number of equities that we use for the two datasets in the current study. This table shows that the construction of the 'original' portfolios of equities was done using the 18 larger size companies, the next 36 middle size companies and, last, the 70 smaller size companies of ASE. We use the above three portfolios of equities as a benchmark in order to compare these with the three 'created' portfolios of equities.

These three 'created' portfolios of equities are formed according to the *R*-squared metric of a regression which takes into account the Timeliness of Earnings measure as it is shown in the section of methodology. Based on the above process, the CFTSE18 stock portfolio contains 1 equity from the OFTSE18 stock portfolio, 5 equities from the OFTSE36 stock portfolio and 12 equities from the OFTSE70 stock portfolio. The CFSTE36 portfolio contains 4 equities of the OFTSE18 stock portfolio, 11 equities of the OFTSE36 stock portfolio and 21 equities of the OFTSE70 stock portfolio. The CFTSE70 contains 13 equities from the OFTSE18 stock portfolio, 20 equities of the OFTSE36 stock portfolio and 37 equities of the OFTSE70 stock portfolio. Thus, the 'created' three stock portfolios are not similar in the number of equities they contain and their contribution to the degree of market integration process in ASE is compared with the 'original' three portfolios containing a similar amount of equities to the 'created' ones.

Table 2. Number of 'original' stock equities that used for the construction of the 'created' portfolios

	OFTSE18	OFTSE36	OFTSE70	SUM
CFTSE18	1	5	12	18
CFTSE36	4	11	21	36
CFTSE70	13	20	37	70
SUM	18	36	70	124

Notes: OFTSE18, OFTSE36 and OFTSE70 are the 'original' portfolios, while CFTSE18, CFTSE36 and CFTSE70 are the 'created' portfolios based on the *R*-squared metric measure of Timeliness of Earnings regression.

Tables 3 and 4 present the results of volatility and error spillovers and volatility and error persistence of the martingale-GARCH-BEKK model. "Volatility spillovers" are necessary since they account for the magnitude and persistence of stock returns fluctuations within and across different portfolios. Also, volatility spillovers concern the stock market integration regarding linkages among portfolios of different size stock equities. Error spillovers refer to linkages among portfolios of large, medium and small equities in ASE, for which some remained unexplained. Information is transmitted within the market in order to change investors' preferences due to inefficiency or segmentation of ASE.

Table 3 reports the results of volatility and error spillovers of the three 'original' Greek portfolios of equities and their diagnostic tests, while Table 4 reports the findings of the 'created' Greek portfolios of equities and their diagnostic tests. The spillovers results of both volatility and error in Table 3 are not statistically significant for one volatility spillover case [from OFTSE36 to OFTSE70 (-0.0083)] and for two error spillovers results [from OFTSE18 to OFTSE36 (-0.37) and also from OFTSE36 to OFTSE70 (0.0047)]. On the other hand, Table 4 shows that there are three volatility spillovers [from CFTSE18 to CFTSE36 (-0.0035), from CFTSE70 to CFTSE36 (0.0027) and from CFTSE70 to CFTSE36 (-0.0045)] and one error spillover [from CFTSE36 to CFTSE18 (0.015)] that are not statistically significant. There are no similarities in the spillovers of the above findings. This might be due to the fact that these spillovers contain different quality and quantity of equity information. Thus, Timeliness of Earnings measure and the movement of equities' returns explain, partly, the degree of market efficiency and integration, owing to the lack of quick response to the news that affects the market and have been incorporated into account reports. In relation to persistence, the empirical outcomes indicate that the "original" portfolio of OFTSE70 (0.21) is statistically insignificant. Therefore, news in this case does not remain for a shorter period neither it remains for a longer period.

All the above findings show that the integration process for the "original" Greek portfolios of equities is due to "volatility spillovers", while the integration process of the "created" portfolios of equities is due to "error spillover". Diversification, in general, is based on the creation of portfolios in order to reduce risk not mainly attributed to stock price volatility spillovers. Thus, as systematic market risk is not diversified, investors should reduce error spillovers, taking information from accounting reports. In particular, they could measure the Timeliness of Earnings metric and how quickly this news (error spillovers) is recognized. This is predominately owed to the fact that in ASE error spillovers are slightly more dominant among the three 'created' stock portfolios than among the "original" portfolios.

Diagnostic tests indicate that there is no great difference in the mean distribution of residuals and their respective squared-residual values. In addition, the empirical results of autocorrelation show that there is a significant degree of autocorrelation for all of residuals and squared residuals and their cross-product residual values. This holds for the portfolios of the "original" and the "created" ones. The significance of residuals and squared residuals is not reduced even if we increase the number of autoregressive factors in the mean return equation of the GARCH-BEKK model.

Table 3. Maximum likelihood estimates of the martingale GARCH-BEKK model for interdependencies among 'original' portfolios of equities

Mean equation: $R_{i,t} = \mu_{i,t} + \varepsilon_{i,t}$. Volatility equation: $H_t = CC' + A'H_{t-1}A + Z'\varepsilon_{t-1}\varepsilon'_{t-1}Z$.

'Original' Greek portfolios	OFTSE18(1) OFTSE36(2) OFTSE70(3)
Period: 01/01/1993-16/02/2008	Contemporaneous correlation
Mean equation	
μ_1	0.00065* (0.00012)
μ_2	0.00021** (0.000092)
μ_3	0.00021** (0.000097)
Volatility transmission	
Volatility transmission from OFTSE18 to OFTSE36 (A_{21})	0.24* (0.060)
Volatility transmission from OFTSE36 to OFTSE18 (A_{12})	-0.12* (0.027)
Volatility transmission from OFTSE18 to OFTSE70 (A_{31})	0.037*** (0.019)
Volatility transmission from OFTSE70 to OFTSE16 (A_{13})	-0.16* (0.034)

Table 3 (cont.). Maximum likelihood estimates of the martingale GARCH-BEKK model for interdependencies among 'original' portfolios of equities

'Original' Greek portfolios			OFTSE18(1) OFTSE36(2) OFTSE70(3)
Volatility transmission from OFTSE36 to OFTSE70 (A_{32})			-0.0083 (0.010)
Volatility transmission from OFTSE70 to OFTSE36(A_{23})			0.068* (0.023)
Error transmission			
Error transmission from OFTSE18 to OFTSE36 (Z_{21})			-0.37 (0.044)
Error transmission from OFTSE36 to OFTSE18 (Z_{12})			0.078 (0.028)*
Error transmission from OFTSE18 to OFTSE70 (Z_{31})			-0.14 (0.040)*
Error transmission from OFTSE70 to OFTSE16 (Z_{13})			0.071** (0.030)
Error transmission from OFTSE36 to OFTSE70 (Z_{32})			0.0047 (0.031)
Error transmission from OFTSE70 to OFTSE36 (Z_{23})			0.102* (0.027)
Volatility persistence			
OFTSE18 (A_{11})			0.49* (0.084)
OFTSE36 (A_{22})			1.019* (0.016)
OFTSE70 (A_{33})			0.972* (0.010)
Error persistence			
OFTSE18 (Z_{11})			0.57* (0.043)
OFTSE36 (Z_{22})			0.31* (0.027)
OFTSE70 (Z_{33})			0.21 (0.029)
Likelihood ratio tests			
Log-likelihood			38447.86560080
Model diagnostics			
	OFTSE18	OFTSE36	OFTSE70
$E(z_{i,t})$	-0.00019	0.000009	-0.00022
$E(z_{i,t}^2)$	0.00012	0.000188	0.00017
LB(12); $\theta_{i,t}$	70.43*	157.204*	154.39*
LB(12); $\theta_{i,t}^2$	294.56*	1579.9540*	1242.36*
JB	8017.02*	4353.039*	4586.58*
LB(12) for cross product of residuals			
$LB(\theta_{1,2})$ = 1254.92*, $LB(\theta_{1,3})$ = 579.50*, $LB(\theta_{2,3})$ = 1597.10*			

Note: *, **, *** shows significance at the 1%, 5% and 10%. Numbers in parentheses are the standard errors. LB(*n*) is the Ljung-Box statistic for up to *n* lags (distributed as x^2 with n degrees of freedom). JB testing for normality; $\theta_{i,t}$ is the residual for equity portfolio *i*.

Table 4. Maximum likelihood estimates of the martingale GARCH-BEKK model for interdependencies among 'created' portfolios of equities

Mean equation: $R_{i,t} = \mu_{i,t} + \varepsilon_{i,t}$. Volatility equation: $H_t = CC' + A'H_{t-1}A + Z'\varepsilon_{t-1}\varepsilon'_{t-1}Z$.

'Created' Greek portfolios	CFTSE18(1) CFTSE36(2) CFTSE70(3)
Period: 01/01/1993-16/02/2008	Contemporaneous correlation
Mean equation	
μ_1	0.000068 (0.000109)
μ_2	0.000203** (0.000099)

Table 4 (cont.). Maximum likelihood estimates of the martingale GARCH-BEKK model for interdependencies among 'created' portfolios of equities

'Created' Greek portfolios			CFTSE18(1) CFTSE36(2) CFTSE70(3)
μ_3			0.00028* (0.000100)
Volatility transmission			
Volatility transmission from CFTSE18 to CFTSE36 (A_{21})			-0.0035 (0.0042)
Volatility transmission from CFTSE36 to CFTSE18 (A_{12})			-0.0045** (0.0019)
Volatility transmission from CFTSE18 to CFTSE70 (A_{31})			-0.043* (0.0055)
Volatility transmission from CFTSE70 to CFTSE16 (A_{13})			0.0027 (0.0021)
Volatility transmission from CFTSE36 to CFTSE70 (A_{32})			-0.032* (0.0053)
Volatility transmission from CFTSE70 to CFTSE36 (A_{23})			-0.0045 (0.0044)
Error transmission			
Error transmission from CFTSE18 to CFTSE36 (Z_{21})			0.11* (0.027)
Error transmission from CFTSE36 to CFTSE18 (Z_{12})			0.015 (0.016)
Error transmission from CFTSE18 to CFTSE70 (Z_{31})			0.15* (0.026)
Error transmission from CFTSE70 to CFTSE16 (Z_{13})			-0.041** (0.017)
Error transmission from CFTSE36 to CFTSE70 (Z_{32})			0.13* (0.025)
Error transmission from CFTSE70 to CFTSE36 (Z_{23})			0.068** (0.028)
Volatility persistence			
CFTSE18 (A_{11})			0.99 (0.0019)*
CFTSE36 (A_{22})			0.98* (0.0043)
CFTSE70 (A_{33})			0.94* (0.0061)
Error persistence			
CFTSE18 (Z_{11})			0.049* (0.017)
CFTSE36 (Z_{22})			0.17* (0.028)
CFTSE70 (Z_{33})			0.31* (0.028)
Likelihood ratio tests			
Log-likelihood			38447.86560080
Model diagnostics			
	COFTSE18	CFTSE36	COFTSE70
$E(z_{i,t})$	-0.00013	-0.00017	-0.000094
$E(z_{i,t}^2)$	0.00014	0.00015	0.00014
LB(12); $\theta_{i,t}$	116.183*	112.41*	151.019*
LB(12); $\theta_{i,t}^2$	873.33*	333.31*	1622.918*
JB	4073.75*	15682.40*	3917.62*
LB(12) for cross product of residuals			
$LB(\theta_{1,2})$ = 1213.38*, $LB(\theta_{1,3})$ = 1417.94*, $LB(\theta_{2,3})$ = 1142.80*			

Note: * Shows significance at the 5%. Numbers in parentheses are the standard errors. LB(n) is the Ljung-Box statistic for up to n lags (distributed as x^2 with n degrees of freedom). JB testing for normality. $\theta_{i,t}$ is the residual for equity portfolio i.

Tables 5 and 6 are based on a nested-GARCH-BEKK model. The first one (the mean return equation) shows whether the 'original' and 'created' stock portfolios follow the positive feedback trading approach or the autocorrelation (LeBaron) approach. Table 5 shows a statistically significant preference to the autocorrelation approach for 'original' portfolios without completely rejecting the positive feedback trading approach. In particular, the coefficients of positive feedback trading ($\beta_{1,3}$, $\beta_{2,3}$ and $\beta_{3,3}$) for the mean return equation of the 'original' stock portfolios are negative and significant for the two out of the three portfolios at 5% (for OFTSE18 it is -101.509) and at 10% (for OFTSE70 it is -45.86) significance levels. At the same time, the coefficients of the autocorrelation process ($\beta_{1,4}$, $\beta_{2,4}$ and $\beta_{3,4}$) are significant, statistically, in all the 'original' stock portfolios of ASE at a 1% level of significance. Thus, the autocorrelation process has been found to be superior to the positive feedback trading of the 'original' portfolios of equities. Therefore, a reduction in market efficiency might be due to this phenomenon (e.g. autocorrelation)

On the other hand, in Table 6, we present the analysis of the positive feedback trading and autocorrelation approaches to the three 'created' stock portfolios. It is crystal clear that the presence of autocorrelation is obvious at a 1% significance level, without the presence of the positive feedback trading process at all. This means that investors do not buy equities when prices are high and do not sell equities when prices are low. However, an investor or a risk manager should be based on the previous day's information for the forecast of next day's information, as serial correlation is present in 'created' portfolios series.

The other halves of Tables 5 and 6 show the level of stock market integration. The case of 'original' portfolios of equities shows that the Greek market is equally 'volatility spillover' and 'error spillover' oriented both having a significant role in the integration process. Based on Table 5, there are two 'error spillover' cases ($z_{1,3}$ and $z_{3,2}$) which are equal to -0.0209 and 0.0094 respectively and two 'volatility spillover' cases ($\alpha_{2,3}$ and $\alpha_{3,2}$) which are equal to -0.0090 and 0.0068 respectively, but not statistically significant. On the other hand, in Table 6, the findings of the 'created' portfolios of equities show that the integration process is more 'volatility spillover' oriented as there are two error spillover cases ($z_{1,2}$ and $z_{3,2}$) which are equal to 0.028 and 0.015 respectively, but not statistically significant.

The above results are slightly different compared to Table 3 findings and are similar to the results of Table 4. We mainly find that the risk is attributed to noise in Table 3 and to volatility in Table 4. These two characteristics offer investors different benefits of portfolio diversification as error can be reduced. However, market risk (volatility stock price risk) cannot. Therefore, the results of stock market integration of Tables 5 and 6 are mixed and either due to volatility or error spillovers for the two studies of 'original' and 'created' portfolios of equities.

The diagnostic tests for both the 'original' portfolios of equities and 'created' portfolios show the presence of serial correlation in residuals. The results of residuals, squared residuals and cross-product ones of LB (12) cannot reduce this phenomenon. This means that series in the volatility equations could be smoothed, taking into account more AR (autoregressive) or MA (moving average) or ARMA (autoregressive moving average) lags. Investors might affect the degree of market efficiency in ASE, reducing the serial correlation in their portfolios. As a result, they should decide on the amount of money they should invest on different stock market portfolios during their trading period by knowing that autocorrelation is a fundamental phenomenon in Athens stock market. Regarding autocorrelation importance, we use LB (12) as a substantial number. However LB (4), (8) or (12) are usually the more common number of lags which measure auto-correlation in finance. We do not use more than 12 lags because when the number of lags increases, the serial correlation does not change substantially.

Table 5. Maximum likelihood estimates of the nested-GARCH-BEKK model for 'original' portfolios of equities

Mean:

$$R_{i,t} = \beta_{i,0} + \beta_{i,1}\sigma^2_{i,t} + (\beta_{i,2} + \beta_{i,3}\sigma^2_t + \beta_{i,4}\exp\{-\sigma^2_{i,t}\})R_{i,t-1} + \varepsilon_{i,t}$$

for $i = 1,2,3$

Variance: $H_t = CC' + A'H_{t-1}A + Z'\varepsilon_{t-1}\varepsilon'_{t-1}Z.$

OFTSE18 (1)		OFTSE36 (2)		OFTSE70 (3)	
$\beta_{1,0}$	0.00017 (0.00013)	$\beta_{2,0}$	0.00012 (0.000089)	$\beta_{3,0}$	0.000094 (0.0000904)
$\beta_{1,1}$	2.76** (1.29)	$\beta_{2,1}$	1.95** (0.804)	$\beta_{3,1}$	1.60 (0.87)**
$\beta_{1,2}$	0.020** (0.010)	$\beta_{2,2}$	0.01071 (0.0071)	$\beta_{3,2}$	0.148* (0.0072)
$\beta_{1,3}$	-101.509** (49.85)	$\beta_{2,3}$	-20.11 (22.53)	$\beta_{3,3}$	-45.86*** (25.64)
$\beta_{1,4}$	0.155* (0.0106)	$\beta_{2,4}$	0.15* (0.0071)	$\beta_{3,4}$	0.044* (0.0072)
$\alpha_{1,1}$	-0.93* (0.013)	$\alpha_{2,1}$	-0.044* (0.011)	$\alpha_{3,1}$	0.049* (0.0065)
$\alpha_{1,2}$	0.024* (0.0091)	$\alpha_{2,2}$	-0.97* (0.0086)	$\alpha_{3,2}$	0.0068 (0.0052)
$\alpha_{1,3}$	0.0309* (0.0094)	$\alpha_{2,3}$	-0.0090 (0.0089)	$\alpha_{3,3}$	-0.95* (0.0058)
$z_{1,1}$	-0.219* (0.028)	$z_{2,1}$	0.082* (0.032)	$z_{3,1}$	-0.208* (0.023)
$z_{1,2}$	-0.045** (0.021)	$z_{2,2}$	-0.307* (0.025)	$z_{3,2}$	0.0094 (0.0190)
$z_{1,3}$	-0.0209 (0.0203)	$z_{2,3}$	-0.047*** (0.025)	$z_{3,3}$	-0.27* (0.0208)

Table 5 (cont.). Maximum likelihood estimates of the nested-GARCH-BEKK model for 'original' portfolios of equities

Model diagnostics			
	OFTSE18	OFTSE36	OFTSE70
$E(z_{i,t})$	-0.00016	-0.000325	-0.000407
$E(z_{i,t}^2)$	0.00011	0.00018	0.00016
LB(12); $\theta_{i,t}$	6.704	37.23*	36.59*
LB(12); $\theta_{i,t}^2$	289.55*	1490.23*	1165.095*
JB	8336.30*	4576.25*	5349.23*
LB(12) for cross product of standardized residuals			
LB($\theta_{1,2}$) = 1251.23*, LB($\theta_{1,3}$) = 568.27*, LB($\theta_{2,3}$) = 1508.27*			

Notes: Numbers in parentheses are asymptotic errors. Stock returns are logarithmic percentage changes. Period: 01/01/1993-16/02/2008. JB testing for normality; LB(n) is the Ljung-Box statistic for up to n lags (distributed as x^2 with n degrees of freedom). $\theta_{i,t}$ is the residual for equity portfolio i. *, **, *** denote significance at the 1%, 5% and 10% level. z_{ij} is the cross product of the standardized residuals.

Table 6. Maximum likelihood estimates of the nested-GARCH-BEKK model for 'created' portfolios of equities

Mean:

$$R_{i,t} = \beta_{i,0} + \beta_{i,1}\sigma_{i,t}^2 + (\beta_{i,2} + \beta_{i,3}\sigma_t^2 + \beta_{i,4}\exp\{-\sigma_{i,t}^2\})R_{i,t-1} + \varepsilon_{i,t}$$

for i = 1,2,3

Variance: $H_t = CC' + A'H_{t-1}A + Z'\varepsilon_{t-1}\varepsilon'_{t-1}Z.$

CFTSE 18 (1)		CFTSE36 (2)		CFTSE70 (3)	
$\beta_{1,0}$	-0.000066 (0.00013)	$\beta_{2,0}$	0.000077 (0.000107)	$\beta_{3,0}$	0.00022** (0.00010)
$\beta_{1,1}$	0.65 (0.98)	$\beta_{2,1}$	0.91 (1.045)	$\beta_{3,1}$	0.52 (0.960)
$\beta_{1,2}$	0.052* (0.0088)	$\beta_{2,2}$	0.067* (0.0074)	$\beta_{3,2}$	0.076* (0.00809)
$\beta_{1,3}$	-17.574 (25.66)	$\beta_{2,3}$	-21.096 (18.43)	$\beta_{3,3}$	21.18 (19.37)
$\beta_{1,4}$	0.062* (0.0090)	$\beta_{2,4}$	0.057* (0.0074)	$\beta_{3,4}$	0.033* (0.0083)
$\alpha_{1,1}$	-0.49* (0.017)	$\alpha_{2,1}$	-1.34* (0.027)	$\alpha_{3,1}$	0.78* (0.018)
$\alpha_{1,2}$	-0.45* (0.00908)	$\alpha_{2,2}$	0.24* (0.013)	$\alpha_{3,2}$	-0.63* (0.015)
$\alpha_{1,3}$	0.13* (0.0065)	$\alpha_{2,3}$	-0.36* (0.0052)	$\alpha_{3,3}$	-0.74* (0.0054)
$z_{1,1}$	0.043** (0.018)	$z_{2,1}$	-0.062* (0.018)	$z_{3,1}$	0.32* (0.025)
$z_{1,2}$	0.028 (0.017)	$z_{2,2}$	0.32* (0.019)	$z_{3,2}$	0.015 (0.0203)
$z_{1,3}$	-0.039** (0.017)	$z_{2,3}$	0.048* (0.013)	$z_{3,3}$	0.33* (0.024)

Model diagnostics			
	CFTSE18	CFTSE36	CFTSE70
$E(\theta_{i,t})$	-0.00012	-0.00015	-0.00015
$E(\theta_{i,t}^2)$	0.00018	0.00014	0.00016
LB(12); $\theta_{i,t}$	39.16*	35.71*	42.92*
LB(12); $\theta_{i,t}^2$	901.065*	320.26*	1518.87*
JB	4418.032*	17196.032*	4118.11*
LB(12) for cross product of standardized residuals			
LB($\theta_{1,2}$) = 1222.1669*, LB($\theta_{1,3}$) = 1397.4084*, LB($\theta_{2,3}$) = 1085.9667*			

Notes: Numbers in parentheses are asymptotic errors. Stock returns are logarithmic percentage changes. Period: 01/01/1993-16/02/2008. JB − testing for normality; LB(n) is the Ljung-Box statistic for up to n lags (distributed as x^2 with n degrees of freedom). θ_{ij} is the standardized residual for market i. *, **, *** denote significance at the 1%, 5% and 10% level. z_{ij} is the cross product of the standardized residuals.

Conclusions

This paper examines the interdependence of six portfolios of equities in ASE, using and comparing two different groups of portfolios. We take into account, firstly, the 'original' portfolios of large, medium and small equities made by the FTSE/ASE indices and, secondly, three 'created' portfolios of equities (large, medium and small equities) according to the R-squared metric of Timeliness of Earnings Regression which measures how quickly news respond to information that is disclosed by firms account reports. The new 'created' portfolios provide more diversification characteristics since they have been generated by the combination of large, medium and small equities. The interdependence among these six portfolios is examined separately for the 'original' and 'created' portfolios, using two approaches of trivariate GARCH-BEKK methodology. These approaches are based on a martingale mean equation and on a nested (positive feedback trading and autocorrelation) mean equation, respectively.

Comparing the results of the two portfolio groups we find that 'created' portfolios are more 'error spillover' oriented − with the martingale approach and more 'volatiltiy spillover' oriented − with the nested approach. In the case of 'original' portfolios, the results of the two approaches are not similar. In particular, we find that the 'original' portfolios of equities are more 'volatility oriented' − with the martingale approach − and equally 'volatility spillover' and 'error spillover' oriented − with the nested approach. Therefore, the market efficiency for the transmission process of information is attributed to both noise and volatility of returns. These results shows that all news, regardless of being unexplained (noise) or stock price movements (volatility), is important to the decision making process for investing on different portfolios in ASE.

The implications of this paper come from the presence of autocorrelation in residuals for the two approaches that are used. The findings show that previous news (volatility and error) affects the next period's volatility and error spillovers. In addition, low risk portfolios can be created looking at the Timeliness of Earnings R-squared metric. Furthermore,

Furthermore, investors can gain some benefits by creating portfolios that are based on the three original indexes, which have different sizes and not only on an individual stock index. Thus, diversifying and focussing on Timeliness of Earnings portfolios, investors can make profits, if they follow an effective and alternative strategy with economic and financial potentiality for them.

Future research can extend our approach and develop this study further to benefit investors from non-linear methodologies.

References

1. Basu, S. (1997). The Conservatism principle and the asymmetric timeliness of earnings, *Journal of Accounting and Economics*, 24, pp. 3-37.
2. Ball, R. and P. Brown. (1968). An empirical evaluation of accounting income numbers, *Journal of Accounting Research*, 6 (2), pp. 159-178.
3. Caporale, G.M., Pittis, N., and Spagnolo, N. (2006). Volatility Transmission and Financial Crises, *Journal of Economics and Finance*, 30 (3), pp. 376-390.
4. Christodoulou, C., Grambovas, C. and McLeay, S. (2007). Differential Timeliness and Persistence in Accounting Earnings. University of Wales Bangor, Working Paper 27.
5. Engle, R.F. and Kroner, K.F. (1995). Multivariate simultaneous generalized ARCH, *Economic Theory*, 11, pp. 122-150.
6. Fu, Y.T, Holmes, J.M., and Choi, D.F.S. (2011). Volatility transmission and asymmetric linkages between the stock and foreign markets: A sectoral analysis, *Studies in Economics and Finance*, 28 (1), pp. 36-50.
7. Frankel R., Sun, Y. and Wang, R. (2007). Asymmetric Timeliness of Earnings and Shareholder Distribution. Leeds Business, Colorado, Working Paper 0708.
8. Hamao, Y., Masulis, R.W., and Ng, V. (1990). Correlations in price changes and volatility across international stock markets, *Review of Financial Studies*, 3 (2), pp. 281-307.
9. Harris, R.D.F. and Pisedtasalasai, A. (2006). Return and volatility spillovers between Large and Small stocks in the UK, *Journal of Business, Finance and Accounting*, 33 (9) and (10), pp. 1556-1571.
10. Jackson, A.B., Dobbie, G.W., and Brown, P.R. (2011). Measures of the Timeliness of Earnings, *Australian Accounting Review*, 21 (3), pp. 222-234
11. Kanas, A. (2000). Volatility spillovers between stock returns and exchange rate changes: international evidence, *Journal of Business, Finance, and Accounting*, 27, pp. 447-467.
12. Karivali, M., Koulakiotis, A., and Papasyriopoulos, N. (2009). On the Timeliness and Conservatism in Earnings per share, *The Journal of World Economic Review*, 4 (1), pp. 19-28.
13. Kohonen, A. (2012). On detection of volatility spillovers in simultaneously open stock markets, University of Helsinki, Helsinki Centre of Economic Research (HECER), Discussion paper No. 346.
14. Koutmos, G. (1997a). Feedback trading and the autocorrelation pattern of stock returns: further evidence, *Journal of International Money and Finance*, 16 (4), pp. 625-636.
15. Koutmos, G. (1997b). Do emerging and developed stock markets behave alike? Evidence from six pacific basin stock markets, *Journal of International Financial markets*, 7, pp. 221-234.
16. Koutmos, G., Pericli, A. and Trigeorgis, L. (2006). Short-term dynamics in the Cyprus Stock Exchange, *European Journal of Finance*, 12 (3), pp. 205-216.
17. LeBaron, B. (1992). Some relations between volatility and serial correlations in stock market returns, *Journal of Business*, 65, pp. 199-219.
18. Sakthivel, P., Bodkhe, N. and Kamaiah, B. (2012). Correlation and volatility transmission across international stock markets: A bivariate GARCH analysis, *International Journal of Economics and Fianance*, 4 (3), pp. 253-264.
19. Sentana, E., and Wadwani, S. (1992). Feedback traders and stock return correlations: Evidence from a century of daily data, *Economic Journal*, 102, pp. 415-425.
20. Taylor, S. and Taylor, S. (2003). Earnings Conservatism in a Continuous Disclosure Environment: Empirical Evidence, University of Technology, Sydney Working Paper.
21. Toyoshima, Y. and Hamori, S. (2012). Volatility transmission of swap spreads among the US, Japan and the UK: A cross-correlation function approach, *Applied Financial Economics*, 22, pp. 849-862.

Appendix. *R*-squared results based on Timeliness of Earnings Regression for the 'original' stock portfolios

Table 7. *R*-squared metric results for FTSE20 Stock index for the period: 1993-2008

OFTSE 18		
	R-squared	*R*-squared (adjusted)
ALPHA	13.70%	13.70%
ATE	3.40%	3.40%
BIOHK	6.70%	6.70%
DEI	19.10%	19.10%
ELAKTOR	8.00%	8.00%
ELPE	5.00%	5.00%
ETE	29.30%	15.20%
EUROCONS.	26.50%	11.70%

Table 7 (cont.). *R*-squared metric results for FTSE20 Stock index for the period: 1993-2008

OFTSE 18		
	R-squared	*R*-squared (adjusted)
INLOT	33.90%	20.70%
CYPROS	11.70%	11.70%
EEEK	1.30%	1.30%
MOH	1.00%	1.00%
MITIL	48.00%	37.60%
OPAP	0.30%	0.30%
OTE	59.70%	49.70%
PIRAEUS	1.60%	1.60%
TITAN	2.50%	2.50%
MIG	0.10%	0.10%

Notes: This table contains 18 equities out of 20 from the FTSE20 stock index. For the other 2 equities we did not have information to run the regression of Timeliness of Earnings.

Table 8. *R*-squared metric results for FTSE40 Stock index for the period: 1993-2008

OFTSE 36		
	R-squared	*R*-squared (adjusted)
AVAX	7.00%	7.00%
VASSILOPOULOS ABK	0.40%	0.40%
ANEK	41.50%	22.00%
BOBOS	83.40%	77.90%
APBA S&B	5.40%	5.40%
ASPIS BANK	1.10%	1.10%
GEK	44.30%	33.10%
GBG GENERAL BANK	1.00%	1.00%
DOL	71.50%	62.10%
ELBAL	44.60%	33.50%
EYATH- EYAPS	40.80%	21.10%
EYDAP	0.10%	0.10%
GREEK FINANCIAL MARKETS	3.70%	3.70%
DOCTOR OF ATHENS	18.30%	1.90%
INTRACOM	61.60%	52.00%
INFO QUEST	0.10%	0.10%
LAMDA DEVELOPMENT	11.70%	11.70%
LOGIC DATA LODIS	75.30%	50.70%
METKA	0.30%	0.30%
ENGINEERS	17.50%	1.00%
MINOA	57.40%	43.30%
JUMBO	14.40%	14.40%
OLTH	39.70%	19.50%
PLASIO	4.90%	4.90%
SARANTIS	36.70%	24.10%
SIDENOR	6.80%	6.80%
SIENS	24.80%	24.80%
SFAKIANAKIS-SFA	5.90%	5.90%
SOLINOURGIKO- SOLK	1.90%	1.90%
HEALTH	14.40%	14.40%
FOLIE	0.10%	0.10%
FORTHNET	99.70%	99.40%
FRIGOGLASS	0.30%	0.30%
FOURLIS	29.40%	5.80%
HALKOR	44.60%	30.80%
ALAPIS	33.30%	11.10%

Notes: This table contains 36 equities out of 40 from the FTSE40 stock index. For 4 equities we did not have information to run the regression of Timeliness of Earnings.

Table 9. *R*-squared metric results for FTSE80 Stock index for the period: 1993-2008

OFTSE 70		
	R-squared	*R*-squared (adjusted)
RURAL INSURANCE AGRAS	7.80%	7.80%
ALKO	0.30%	0.30%
ALUMIL ALMY	8.40%	8.40%
ASKO AS COMPAN.	41.40%	26.80%
ASTIR PALACE	6.40%	6.40%
ATTICA BANK ATT	12.80%	12.80%
AXON	0.90%	0.90%
BALKAN EXPORT	74.20%	48.40%
BARDAS	1.10%	1.10%
BIOTEP	7.10%	7.10%
BOGIATZOGLOU	55.20%	44.00%
BYTE	2.00%	2.00%
GREGORY SMALL-TESTIS	87.60%	75.20%
DIAS PISCICULTURE	4.40%	4.40%
DROMEAS	28.80%	11.10%
BOX FASHION	66.30%	32.60%
DRUG-FARBEN	2.20%	2.20%
ALTER T.V.	49.90%	24.80%
GIS HELLENIC INDUSTRY OF SUGAR	22.20%	2.80%
EDRIP EURODRIP	39.20%	19.00%
ELBE	0.00%	0.00%
ELGEKA	26.50%	11.80%
ELKA HELLENIC CABLE	76.50%	64.70%
EMP COMMERCIAL BANK	31.70%	14.70%
EPILEKTOS	73.50%	60.30%
EURO CONSULTANTS	2.20%	2.20%
ETEM	6.30%	6.30%
EUROPEAN CREDIT	97.50%	95.00%
ZINON	25.30%	25.30%
IKTINOS	0.00%	0.00%
IMPERIO	46.20%	35.40%
INTRAKOM	46.80%	20.20%
KAE	2.00%	2.00%
KANAKIS	1.00%	1.00%
KARDASILARIS	5.00%	5.00%
KARATZI	53.20%	37.60%
KORDELLOU BROTHERS	0.80%	0.80%
KOUMPAS	25.70%	0.90%
KRETA FARM	21.60%	0.80%
KRI KRI	20.30%	20.30%
KIRIAKOULIS	37.90%	22.30%
KYRIAKIDIS MARBLE	45.30%	34.40%
LOULI	94.90%	89.70%
INFORM LYKOS	59.20%	51.00%
MEVACO	0.50%	0.50%
MODA BAGNO	8.30%	8.30%
MOUZAKIS	38.20%	22.80%
BENROUMPI	10.20%	10.20%
MPITROS	25.70%	10.80%
NEORIO SYROS	1.40%	1.40%
NEWSPHONE	99.60%	99.20%
PARNASSOS	10.50%	10.50%
OLP	21.40%	21.40%
PETROPOULOS	4.10%	4.10%

Table 9 (cont.). *R*-squared metric results for FTSE80 Stock index for the period: 1993-2008

OFTSE 70		
	R-squared	*R*-squared (adjusted)
PLASTICS THRACE	17.90%	1.50%
PROFILE	93.10%	86.20%
RILKEN	30.80%	13.50%
RIDENCO	11.70%	11.70%
CYCLON	99.70%	99.30%
SATOK	32.60%	15.70%
SELONTA	0.00%	0.00%
SPACE HELLAS	7.00%	7.00%
YALCO	83.10%	78.90%
FLEXOPACK	11.80%	11.80%
NEXANS HELLAS ALKAT	0.00%	0.00%
ELTON	17.20%	17.20%
BIOKARPET	9.90%	9.90%
CENTRIC	4.60%	4.60%
KALPINIS ELASTRON	1.60%	1.60%
HOL BPAIN	86.90%	80.40%

Notes: This table contains the 70 equities out of 80 from the FTSE80 stock index. For the other 10 equities we did not have information to run the regression of Timeliness of Earnings.