UNIVERSITY OF PIRAEUS

MSc in BANKING AND FINANCIAL MANAGEMENT

THESIS

APT METHODS FOR PASSIVE AND ACTIVE PORTFOLIO MANAGEMENT

SUPERVISOR

ASSOCIATE PROFESSOR: TSIRITAKIS MANOLIS

POSTGRADUATE STUDENT

BIRMPOS DIMITRIOS

PIRAEUS 2002

CONTENTS

INTRODUCTION

The use of multi-index models and multi-index equilibrium models (APT model) in the selection of securities, portfolio management and evaluation of portfolio performance is growing rapidly. Many brokerage firms, financial institutions and financial consulting firms have developed their own multi-index models to aid in the investment process. These models have become increasingly popular because they allow the investor to protect himself against specific types of risk or to make bets on certain types of risk

The APT methods can play a major role in improving passive management. The basic idea of passive management is to track a prespecified stock index. But instead of holding each stock in the proportion that it is represented in the index, a portfolio manager attempts to form portfolios with fewer securities, which have the same set of characteristics with that of a benchmark portfolio. In that way, an investor can 'buy' a well-diversified portfolio with less transaction costs. The arbitrage pricing theory enhances the performance of passive management by offering a thorough insight into the sources of systematic risk that influence stock returns. By matching the sensitivities to the risk factors of a portfolio with those of a benchmark portfolio, we can ensure the minimization of risk but without bearing significant transaction costs.

The use of multi-index models in passive portfolio management can take many forms. But Arbitrage Pricing Theory adds additional insight into the process that influences pricing (expected returns). Every security or portfolio has a risk exposure profile. According to APT, risk exposures are rewarded in the market with additional expected return, and thus the risk exposure profile determines the volatility and performance of well-diversified portfolios. APT tells the investor the expected cost of changing its risk exposure to a risk factor. In that way, an investment manager or an individual investor can control the risk exposure profile of its portfolio.

Active management involves taking a position different from what would be held in a passive portfolio, based on a forecast about the future. In other words, investor forms a portfolio that, while tracking a target, will also produce a return in excess of that index. If investors believe that, inflation will accelerate faster than the other market participants expect to do, they may increase their portfolio's exposure to inflation by holding securities that are more sensitive to inflation changes. The advantage of a multi-index model over the simple index model is that the target index can be tracked more closely because the different sources of risk are explicitly taken into consideration.

The purpose of this analysis is not to test the validity of an APT model in the Greek stock market but to construct a multi-index model, under the assumption that only economic variables affect stock returns, for empirical use in the field of portfolio management. In other words, we want to examine whether a multi-index model, based on the principles of Arbitrage Pricing Theory and adjusted for the particular characteristics of the Greek stock market, can effectively explain the behavior of stock returns and be used in portfolio management.

Our analysis will focus on the application of APT methods in passive and active portfolio management by constructing portfolios with prespecified characteristics of expected return and risk, and by attempting to track benchmark portfolios such as the main stock indices of the Athens Stock Exchange, or even outperform them. So, the main purpose of this work is to examine the usefulness of the estimated multi-index model in portfolio management for the Greek stock market.

This paper is divided into five sections. In section 1, we make a reference to the theoretical background of Arbitrage Pricing Theory in a rather simplistic way and in section 2 we present the main studies dealt with the empirical implementation of APT concept. Section 3 describes the methodology and the data employed in our analysis and section 4 presents the derivation of the expectations generating process and the estimation of the unexpected changes in risk factors. In Section 5 we describe in detail the estimation procedure of a multi-index model based on the APT content while in section 6 we exhibit the application of our multi-index in passive and active portfolio management. Finally, section 7 includes the main conclusions of our analysis. In the appendix, we display the sample of securities employed in tests, the portfolios used in the computation of risk premia, the estimated betas of individual stocks for each risk factor and the final portfolios constructed to track the target indices.

SECTION 1

THEORETICAL BACKGROUND

1.1. APT EQUATIONS

The Arbitrage Pricing Theory Model was developed by Stephen Ross (1976-1977) and is a new and different approach to determine asset prices. APT stipulates a relationship between expected return and risk, but it uses different assumptions in relation to CAPM. It is based on the law of one price: two items that are the same, can't be sold at different prices (Postulate 1)**. This implies that there are no arbitrage opportunities and therefore investors can't construct a zero investment portfolio that will yield a sure (risk-free) profit. The strong assumptions made about the utility theory in deriving the CAPM are not necessary. In fact, the APT description of equilibrium is more general than the one providing by a CAPM-type model, in that it accepts a variety of different risk sources. APT has the following two advantages over the CAPM: 1) It is based upon less restrictive assumptions with respect to investors' preference towards risk and return 2) The market portfolio plays no special role. Moreover the multi-factor APT approach has far greater explanatory power in relation to CAPM. The contribution of APT is in demonstrating how and under what conditions we can go from a multi-index model to a description of equilibrium.**

APT requires that the returns on any stock be linearly related to a set indices in a form that is expressed as follows:

$$R_{it} = a_i + (b_{1i} \times F_{1t}) + (b_{2i} \times F_{2t}) + \ldots\ldots + (b_{ij} \times F_{jt}) + e_i \quad (1)$$

where

i = 1,2 ,.. ,N

a_i = the expected level of return for stock I if all indices have a value of zero
F_j = the value of the jth unknown common factor that affects the security rates of return during the period t
b_{ij} = the sensitivity of stock i's return to the jth factor
e_i = the security i's disturbance term. Security's e's are independent of any other security's e's and each disturbance term has a finite variance σ^2. The expected value of the disturbance term equals zero.

Taking the expected value of equation (1) we produce:

$$E(R_{it}) = a_i + b_{1i} \times E(F_{1t}) + b_{2i} \times E(F_{2t}) + \ldots\ldots + b_{ij} \times E(F_{jt}) \quad (2)$$

Subtracting equation (2) from equation (1) we get the security return generating process:

$$R_{it} = E(R_i) + b_{1i} \times (F_{1t} - E(F_1)) + \ldots\ldots + b_{ij} \times (F_{Jt} - E(F_J)) + e_i \quad (3)$$

where E(Ri) = the expected return at the beginning of period t

. If we call F_j the deviation of the common factor from each expected value, βi the sensitivity of firm i to that factor and e_i the firm-specific disturbance, this multi-factor model states that the actual return on stock i will equal its expected return plus a (zero-expected value) random amount attributable to unanticipated economywide events, plus another (zero expected value) random amount attributable to firm-specific events. **(Postulate 2)**

In this factor model, common factors are assumed to have zero expected value, and by this, they are meant to measure new information concerning the macroeconomy (new information has, by definition, zero expected value); in addition it is assumed the asset specific shock has zero expected value; that is
$E(f_1) = \ldots = E(f_k) = E(e_i) = 0$

It is assumed that the asset-specific shock is uncorrelated with the factor realizations that is
$Cov(e_i,f_i) = 0$ for all j=1,2,...K

Finally, all of the factor realizations and asset-specific shocks are assumed to be uncorrelated across time
Cov{f_j,(t), f_j(t')} = Cov{e_i,(t), e_i(t')} = 0 , for all j= 1,2 ,... ,K and for all $t \neq t'$

These assumptions imply that risk factors are uncorrelated with each other and the only reason stocks vary together is because of the common co-movement with the set of indices that have been specified in that model.

Note that the risk factors themselves may be correlated (inflation and interest rates, for example), as may the asset-specific shocks for different stocks (as would be the case, for example, if some unusual event influenced all of the firms in a particular industry)

As we have mentioned above, the second basic principle of APT is that pure arbitrage profits are impossible. **Postulate 1** is in fact an appealing equilibrium concept. It is hard to imagine any model of financial behavior that fails to conclude that pure arbitrage profits tend to zero. Because of this assumption, APT is free of restrictive assumptions on preferences or probability distribution and it provides rigorous logical foundation for the tradeoff between expected returns and risks.

Given postulates 1 and 2, the main APT theorem is that there exist K+1 numbers $\lambda_o,\lambda_1,...,\lambda_K$, not all zero, such that the expected return on the i[th] asset is approximately equal to λ_o, plus the sum over j of β_{ij} times λ_j; that is,

$$E(r) = \lambda_o + \beta_{I1} \times \lambda_1 + \ldots \beta_{IK} \times \lambda_K . \quad (4)$$

Here λ is the price of risk or the risk premium for the j^{th} risk factor and it represents the increase in expected return for a one-unit increase in beta. If we form a perfectly diversified portfolio, with no factor exposures (b=0), then it will have zero risk. Then the λ_o must be the risk-free rate of return.

The APT model that arises from this return generating process is

$$E(R_i) = Rf + \sum \lambda_j b_{ij} \quad (5)$$

We have to notice here that every security has a unique sensitivity (beta) to each factor F, but also F has a value that is the same for all securities. The factors affect the returns on more than one security and are the sources of covariance between securities. The b's are unique to each security and represent the sensitivity of the security to a particular factor. Finally λ is the extra-expected return required because of security's sensitivity to a factor.

The expected return given by the previous equation is rarely equal to the actual return. Factors seldom do exactly what is forecasted for them, because the idiosyncratic portion of return, $\varepsilon_i(t)$, is almost never zero. Then the actual return on the ith asset is

$$r = E[r(t)] + U[r(t)] \quad (6)$$

,where U[r(t)] is the unexpected return given by

$$U(r_{it}) = \beta_{i1} \times F_{1t} + \beta_{2i} \times F_{2t} + ... + \beta_{ij} \times F_{Jt} + \varepsilon_\iota(t) \quad (7)$$

Suppose now that we consider a historical sample period t = 1,...,T. The mean ex post actual return for the ith asset is

$$\overline{r}_{it} = \overline{E}(r_i) + \overline{U}(r_i) = \overline{E}(r_i) + (\sum \overline{\beta}_{iK} \times \overline{F}_k) + \overline{\varepsilon}_\iota \quad (8)$$

That is the historical mean return for the i[th] asset is equal to the sum of the mean ex post expected return and the mean of the surprise components of return. The mean ex post unexpected macroeconomic factor return is

$$\beta_{i1}\ \overline{F}_{1t} + \beta_{2i} \times \overline{F}_{2t} + ... + \beta_{ij} \times \overline{F}_{Jt} \quad (9)$$

and the ex post sample period alpha for the i[th] asset is $\alpha_i \equiv \overline{\varepsilon}_\iota$ (10)

Putting all this together, the mean ex post actual return on an asset is equal to the mean ex post expected return, plus the mean ex post unexpected macroeconomic factor return plus α_i. The first term of this equality measures the rewards for risks and it is the reward that a manager receives, which is attributable to the risk exposure profile for the portfolio. The second term has two possible interpretations: If a manager has taken intentional macroeconomic bets, the unexpected macroeconomic factor return measures the success or failure of those bets. On the other hand, if a manager is not intentionally making factor bets, the unexpected return can be interpreted simply as a measure of good or bad luck in this sample period. The last term,α_i, is a measure of a manager's selection of individual stocks that perform better or worse than a priori expectations and is the measure of APT selection.

By construction all of the economic factors have zero population mean, so over long historical periods, their sample means will be approximately zero. Thus, over long historical sample periods, the contribution to return from macroeconomic surprises will be approximately zero and the mean realized return will be rewards for risks and stock selection.

1.2 APT TESTING

Research into the multifactor nature of security returns is yet inconclusive. Identifying the factors and investigating the risk premia of securities as a function of their factor loadings (betas) present great statistical difficulties.

Two lines of inquiry have been pursued. In the first, researchers analyze security returns statistically to discern the significant factors and to construct portfolios that are highly correlated with those factors. Then, they estimate the average returns on these portfolios to determine whether these factors command risk premia. The second approach is to prespecify likely economic factors or firm characteristics and identify portfolios that are highly correlated with these attributes. The risk premia on these portfolios are then estimated from sample average returns.

In exploratory factor analysis the exact number of factors is not known and factors and firm attributes (b's) are estimated simultaneously. Typically, a model with no factors is first fit to the data. This model assumes that asset returns are mutually uncorrelated. The goodness-of-fit measure from the model serves as a base value to express the total variability of in returns. The researchers then fit a succession of factor models with increasing number of factors, comparing the goodness-of-fit measure of the various models. As each additional factor is added, a large improvement in the goodness-of-fit measures suggests that this is an important underlying factor that should be included. A small improvement in the fit suggests that the additional factor may have no real significance. In general, factor analysis determines a specific set of factors and betas such that the covariance of residual returns is as small as possible. But using this technique, it is not possible to be sure that one has captured all relevant factors. Without a theory of how many factors should be present, the decision as to how many to extract from the data has to be made subjectively.

The other avenue to test multifactor equilibrium APT is to specify a set of attributes (firm characteristics) or a set of economic influences that are believed to capture the relevant influences affecting security returns. An alternative approach is to choose portfolios that are designed to account for macroeconomic factors or firm characteristics and test the multifactor model with these portfolios. In both cases, betas can be obtained by regression analysis and then they can be used for the estimation of risk premia. If we could specify a priory a set of characteristics that affects returns, then the market price of these characteristics could be measured fairly easily.

Under the factor analysis, factors are simply derived from the data. Thus, the first advantage of factor analysis is that prior knowledge about the factors is not required. Based on derived factors with means of zero, one can always form arbitrage portfolios, which eliminate exposure to any kind of factor risk. In contrast, the implication of a macrovariable model requires specifying factors in advance, and factors are interpreted as specific economic phenomena. This prespecification gives no guarantee to construct arbitrage portfolios. But there are a number of drawbacks associated with factor analysis. Firstly, factor analysis results are very sensitive to the size and the nature of the sample under study. In addition, the almost complete lack of economic meaning attached to the factors obtained from this method makes it difficult to interpret the statistical results.

The use of macroeconomic variables as the pervasive factors has two significant over factor analysis. First, it is not subject to the statistical problems peculiar to the use of factor analysis. Second, macroeconomic factors introduce additional information, linking asset price behavior to economic events rather than using only asset prices to explain asset prices. In this approach we use economic information in addition to stock returns, whereas the factor analysis uses 'stock returns to explain stock returns'. The main disadvantages of this method are the lack of formal guidance for choosing the variables and that economic variables are measured with errors, particularly over short horizons.

Several authors have raised the issue of the testability of the APT**. Chen and Jordan (1993**) compared the explanatory power of a factor-loading model (FLM) with that of a macroeconomic variable model (MVM) and find that these models have almost the same ability in explaining the cross-sectional variation in stock returns. They used the monthly returns for 69 industry portfolios in an original sample and for 30 equally weighted portfolios in a holdout sample, while the selection of the macrovariables was based on the previous paper of Chen et al (1986). For the evaluation of the performance of these models, the authors ran a Davidson and Mackinnon test and a Theil's U^2 test. In addition, they ran a single cross-sectional GLS regression for each model by using the average excess return associated with each industry portfolio as the dependent variable and compared the resulting regression R^2. This set of tests suggested the viability of the MVM to the FLM. Factor analysis outperformed macrovariables in explaining the variation in excess returns across portfolios but this finding it is anticipated, given the fact that the FLM factors are sample specific. But two out of three tests, conducted for a holdout sample, have revealed that the MVM does a better job than the FLM in predicting portfolio returns. Overall, these empirical results have indicated that a model based on economic factors may turn to be superior to a factor-loading model, especially in a holdout sample.

Dhrymes, Friend and Gultekin (1984) **presented evidence that the number of factors that appear significant is an increasing function of the size of the group studied. They discovered that as the number of securities included in the factor analysis increases from 15 to 60, the number of significant factors increases from 3 to 7. The authors suggested that dividing the sample into subgroups may ignore important sources of covariance between the securities in different groups, and, further, that the factor identified within any subgroup may not be the same as the factor identified in a second subgroup. They also found that the number of priced factors depends on the number of observations in the time series and that the number of priced factors increases with the number of securities factor analyzed. Overall, these initial empirical results indicate that the APT may be difficult to test if we employ factor analysis to conduct the test.**

The number of factors problem has been debated for more than a half-century and gives the motive for extensive research. Roll and Ross (1980) concluded that no more than four or five factors are relevant. Brown and Weistein (1983) claimed that the number of factors should be no more than five. Oldfield and Rogalski (1981) Chen (1983) and Burmeister, Roll and Ross (1994) conducted their tests by prespecifying the number of factors at five, while Chen, Roll and Ross (1986) selected also five economic variables in their study,

while. Priestley et al (1998) found that there are six common factors that can be used to price securities

Also, **Diacogiannis (1986)** has criticized the validity of APT. The empirical tests of the APT assume that the stock returns are affected by a small number of unobservable factors, which remain the same across different groups of securities. To test these hypotheses, Diacogiannis employed monthly data from November 1956 to December 1981 for 200 British securities, listed on the London Stock Exchange for the entire sample period. These securities were used to form randomly five master groups of 40 securities each. Then from each master group, seven subgroups were formed. Diacogiannis has proved that it is very difficult to assess which is the appropriate group size that should be used in order to investigate the empirical validity of APT. Moreover he indicated that the number of factors that affects returns changes throughout the time. As a consequence, the Arbitrage Pricing Model is not reliable for forecasting purposes.

SECTION 2

LITERATURE REVIEW

There have been a considerable number of studies, which attempt to justify the empirical applicability of the Arbitrage Pricing Theory. Most empirical work on the APT has followed a factor analysis. Many studies have also endeavored to identify the macroeconomic factors underlying the APT. In this section, we present some of the most important empirical studies that examine the ability of APT model to explain asset prices

Roll and Ross (1980) conducted the initial empirical test of the APT. Their empirical tests of the APT followed a two step procedure. In the first step, the expected returns and the factor coefficients are estimated from time series data on individual asset returns. The second step uses these estimates to test the basic cross-sectional pricing conclusion of the APT. Roll and Ross calculated the factor betas by using a maximum-likelihood factor analysis. The input to factor analysis is the covariance matrix between the returns to the securities in the sample. Then, the individual asset-factor loading estimates are used to measure the value and the statistical significance of risk premia λ associated with estimated factors. The procedure here is similar to a cross-sectional generalized least-squares regression. Because of its complexity, factor analysis can only be employed on a relatively small number of stocks at a time. Roll and Ross applied the analysis to 42 groups of 30 stocks, by using daily data for the time period July 1962 to December 1972. The results of their first-pass test showed that in over 38% of the groups, there was less than a 10% chance that a sixth factor had explanatory power and in over 75% of the groups there was a 50% chance that 5 factors were sufficient. So, they found that four or possibly five different factors have significant explanatory power. Moreover they tested for the impact of residual risk and discovered that the residual variance of securities is unrelated to average returns. This inference can be regarded as an additional element of empirical support for the validity of APT framework.

Diacogiannis and Tsiritakis (1997) applied factor analysis to examine, whether a multi-factor equilibrium model can describe return generating process on the Athens Stock Exchange. They employed 19 representative macroeconomic variables of the Greek economy, for the period 1980-1992, divided into two subperiods (1980-1986 and 1986-1992). Because of the interactions between economic sectors and macrovariables, principal component methodology was employed to avoid the problem of multicollinearity. Their tests shown that three factors explain over 84% of the variation in stock returns. Next, they employed the returns of 70 individual firms and used the two-pass regression approach of Fama-McBeth for the estimation of factor loadings in the first-pass and of the risk premia in the second-pass. The authors found that there are two statistically significant macroeconomic factors in the first, and three factors in the second subperiod, which seem to systematically affect expected returns in the Greek stock market. The main conclusion of their study was that a version of APT, based on the existence of independent economic variables, is capable of explaining the cross-sectional variation in stock returns.

Lehman and Modest (1988) implemented the idea of forming portfolios of assets that mimic factor realizations (returns). They formed a portfolio that has minimum residual risk for each factor, and used this set of portfolios as independent variables to estimate the sensitivities of each of a large number of securities to each factor. Each portfolio was constructed by finding a set of weights summing to one across stocks, so that the portfolio has minimum residual risk and a sensitivity of zero to all factors except the one under study. The authors showed that a multi-index APT can explain away discrepancies due to dividend yield and own variance, but that the extra return on small firms and in January is only partially accounted for by the model.

Fama and French (1992) studied the ability of firm characteristics in capturing the cross-sectional variation in average stock returns. In their asset-pricing tests they used the cross-sectional regression approach of Fama-McBeth during the period 1963-1990. They found that the relation between coefficient β and average returns disappears during the sample period, even when betas are used alone to explain average returns. Also, they studied the relations between expected returns and four firm characteristics; 1) firm size 2) leverage 3) E/P ratio and 4) book-to-market equity. Fama and French noted that these firm characteristics are strongly associated with average returns and that the combination of size and book-to-market equity seems to absorb the role of leverage and E/P ratio in explaining average returns. So, they concluded that two firm characteristics, size and book-to-market equity can provide a powerful characterization of the cross-section of average stock returns. In a later paper, Fama and French showed that the firm's size and the book-to-market effects can be accounted for within a three-factor model, in which the factors are the returns on the market portfolio, and on two zero net-investment portfolios, one of which is long in high book-to-market and short in low book-to-market securities and the other is long in small firms and short in large firms.

One of the very first attempts to evaluate and forecast the general level of stock prices with the use of multi-index models was made by **Michael Keran (1971)**. In trying to isolate the important factors that affects stock prices, Keran applied the multiple regression method to quarterly data of some economic and financial factors over the period from 1956 to 1970. He found the following multiple regression equation that could explain fairly well the determination of stock prices:

$$SP_t = -30{,}68 + \sum_{i=0}^{2} 1{,}31 M_{t-i} - \sum_{i=0}^{7} 5{,}37 X_{t-i} - \sum_{i=0}^{16} 11{,}96 P_{t-i} + \sum_{i=0}^{19} 4{,}8 E_{t-i}$$

where: SP_t = the level of Standard and Poor's Composite Index in current period
M_{t-i} = the lagged change in the real money stock
X_{t-i} = the changes in real growth measured by changes in current and lagged real GNP
P_{t-i} = the changes in expected inflation measured by changes in current and lagged prices.
E_{t-i} = expected real corporate earnings measured by current and lagged values of real corporate earnings.

The Keran's equation has a small standard error (2,49) and a high R^2 of 0,98, which means that the changes in the four independent variables presented above, could adequately explain the variation in the level of the S&P's 500 stock index. Using several groups of data from the first quarter of 1967 to the fourth quarter of 1970, Keran tested the model for its ability to predict the future. His simulations indicated that his model could generate accurate ex ante predictions, of the general level of stock prices, from four to six quarters beyond the initial point of forecasting.

Many years later, **Chen, Roll and Ross (1986)** wrote one of the most important empirical works on the arbitrage pricing theory and the impact of economic forces on stock returns. This paper tested whether innovations in macroeconomic variables are risks that are rewarded in the stock market. For the specification of unanticipated changes in economic factors, they assumed that economic time series follows a 'random walk process' and obtained the time series of unexpected movements by taking the first difference of their economic series. Then, they hypothesized that five macroeconomic variables should systematically affect stock prices returns:

- Monthly growth in industrial production (MP)
- Changes in expected inflation measured by changes in short-term interest rates (DEI)
- Unexpected inflation defined as the difference between actual and expected inflation (UI)

- Unexpected changes in risk premia measured by the difference between the returns on corporate 'Baa and under' bonds and long –term government bonds (UPR)
- Unexpected changes in the term structure measured by the difference between the returns on long- and short-term government bonds (UTS).

With the identification of these potential economic factors, Chen, Roll and Ross skipped the procedure of identifying factor portfolios. The next step in their study was the grouping of stocks into portfolios, in order to control the errors-in-variables problem and to reduce the noise in individual stock returns. To accomplish this, they chose to sample stocks into 20 equally-weighted portfolios by size (market value of outstanding equity), a variable that is known to be associated with stock returns.

A version of the Fama-McBeth (1973) technique was employed to ascertain whether the economic state variables are relate to the underlying factors that explain pricing in the stock market.

They first used five years of monthly data to estimate the factor betas of the 20 portfolios in a first-pass regression. This is accomplished by estimating the following regressions for each portfolio.

$$R = a + b_{MP}MP + b_{DEI}DEI + b_{UI}UI + b_{UPR}UPR + b_{UTS}UTS + e$$

where the betas are the loadings on the state variables, a is the constant term and e is an idiosyncratic error term. Using the 20 sets of first-pass estimates of factor betas as the independent variables, they estimated 12 cross-sectional regressions, one regression for each of the next 12 months.

This second-pass regression has the following form:

$R = \gamma_o + \gamma_{MP}b_{MP} + \gamma_{DEI}b_{DEI} + \gamma_{UI}b_{UI} + \gamma_{UPR}b_{UPR} + \gamma_{UTS}b_{UTS} + e$, where the gammas are

the estimated risk premia on the factors. These steps are then repeated for each year in the sample, yielding for each macrovariable, a time series of estimates of its associated risk premium. Then, the time-series means of these estimates are tested by a t-test for significant difference from zero.

The authors broke the test period into four sub-periods, beginning with Jan 1958. They found that over the entire sample period MP, UI and UPR were significant, while UTS was marginally so. On the contrary, the inflation related variables, DEI and UI were highly significant only for one sub-period and insignificant for the rest. In addition, they found that MP and UPR have a positive risk premium while UI, DEI and UTS carry negative prices of risk.

Finally, they tested the pricing influence on the market indices. For this purpose, they included two versions of the market index; the value-weighted

NYSE index (VWNY) and the equally-weighted NYSE index (EWNY). They found that the market index fails to have a statistically significant effect on stock pricing, while the macrovariables maintains their explanatory power.

Burmeister, Berry and McElroy (1988) continued the development of a multi-index model building, based on the work of Chen, Roll and Ross. The authors assumed that stock returns are generated by the following five indices

- Default risk, as measured by the return on long-term government bonds minus the return on long-term corporate bonds plus one half of 1 percent.
- Time premium, as measured by the return on long-term government bonds minus the one-month T-bill tare one month ahead
- Deflation, as measured by the expected inflation at the beginning of the month minus actual inflation during this month
- Change in expected sales, as measured by the expected long-run growth rate in real final sales expected at the beginning of the month minus the expected long-run growth rate in real final sales expected at the end of the month.
- The market return not captured by the first four variables. This factor is a proxy for any unobserved general influences and is estimated by taking the residuals from a regression of a diversified portfolio (S&P composite index) against the first four observable variables.

The authors found that the first four economic variables account for about 25% of the variation in the return on the S&P composite index and that each of the four coefficients is significant. When they computed the sensitivities of each firm to these factors, they noticed that more than the two-thirds of the betas are statistically important at the 5% level and the five variables explain 30% to 50% of the variation of returns of individual firms. Changes in risk premia and growth rate are appeared to have a negative impact on stock prices while the other three variables have significant positive coefficients. Moreover, the prices of risk (λ's) for each of the five systematic risk factors were all positive and statistically different from zero. In addition, Burmeister and McElroy tested the explanatory power of the market index alone. They searched that the additional explanation of the four variables is statistically significant even when the APT form of the return-generating process is used.

Burmeister, Roll and Ross (1994) have argued that five sources of systematic risk mostly explain variation in stock returns: 1) confidence risk 2) time horizon risk 3) inflation risk 4) business cycle risk 5) market-timing risk.

Confidence risk is the unanticipated changes in investors' willingness to undertake relatively risky investments. It is measured as the difference between the rate of return on relatively risky corporate bonds and the rate of return on government bonds. The

intuition is that a positive return difference reflects increased investor confidence because the required yield on risky corporate bonds has fallen relative to safe government bonds. Burmeister et al found that most equities do have a positive exposure to confidence risk (their price will rise) and small stocks generally have greater exposure than large stocks.

Time horizon risk is the unanticipated changes in investors' desired time to payouts and it is measured as the difference between the rate of return on long-term government bonds and the rate of return on short-term government bonds (they use 30-day T-bills). A positive realization of time horizon risk means that investors require less compensation for holding investments with relatively longer maturity. Growth stocks benefit more than income stocks when time horizon risk rises.

Inflation risk is the difference between the actual inflation for a month and what had been expected at the beginning of that month. To the extent that investors are concerned with real cash flows the rate of inflation should affect stock prices. The authors searched that most stocks have negative exposures to inflation risk which means that a positive inflation surprise causes a negative contribution to stock returns. Luxury-products are more sensitive to inflation risk while firms selling necessities are relatively insensitive to inflation risk. Examples include foods and pharmaceutical companies.

Business cycle risk represents unanticipated changes in the level of real business activity. It is calculated as the difference between the expected end-of-month growth rate of economy and the expected beginning-of month value. A positive realization of business cycle risk indicates that the expected growth rate has increased. Firms that are more positively exposed to this kind of systematic risk are those of retailing commerce, which outperform utility companies.

The last variable that Burmeister et al selected as a common pervasive risk factor is market-timing risk. It is computed as that of the total return on market index that is not explained by the first four macroeconomic risk factors. As a proxy for the market they use the return on the S&P index. Almost all stocks have a positive exposure to market-timing risk and hence surprises in market-timing risk tend to have a positive contribution to stock returns.

The authors concluded that the above risk factors have a positive contribution to expected returns with the exception of time horizon risk. In addition, risk prices are negative for two of the aforementioned risk factors, time horizon risk and inflation risk, meaning that stock returns decrease when unanticipated increases in these common risks happen. Finally, they compared the risk exposure profile for Reebok with that of the S&P index and noticed that these exposures give rise to an expected excess rate of return for

Reebok equal to 15,71% and 8,09% for the market index. This finding is not surprising since individual firms entails more risk than the market portfolio.

Finally, **Priestley, Garrett and Antoniou (1998)** investigated the performance of the APT framework for securities traded on the London Stock Exchange and its ability to price assets outside of the sample used for estimation. For this reason, they used two different samples of securities, one for examining the relationship between security returns and macroeconomic variables and one for identifying whether these factors carry the same prices of risk for different subsets of assets. They employed monthly data for both security returns and economic variables during the period January 1980 to August 1993. The factors used in their study were the following macrovariables: 1) unanticipated inflation changes in expected inflation, 2) unanticipated shocks to industrial production, 3) unanticipated shocks to retail sales, 4) unanticipated shocks to money supply, 5) unanticipated shocks to commodity prices, 6) unanticipated shocks to the term structure, 7) unanticipated shocks to default risk, 8) unanticipated shocks to the exchange rate and 9) the market portfolio. Tests showed that an APT specification of six priced factors (the two inflation variables, money supply, default risk, exchange rates and market portfolio) provides a remarkably good description of the behavior of the cross-section of average security returns and explains 75% of the cross-sectional variation. However, only three of these six factors (unexpected inflation, money supply and market portfolio) were unique in the sense that they have carried the same prices of risk in both samples. All in all, the most important finding of this paper was that it is possible to develop a macroeconomic variable, which satisfies the pricing restrictions of APT and has a unique return generating process.

SECTION 3

METHODOLOGY & DATA

3.1 DETERMINATION OF MACROECONOMIC RISK FACTORS

The classical paper of Burmeister, Ross and Roll (1994) will be our guide to the selection of macroeconomic variables that affect stock returns. So, we accept that there are five sources of systematic risk: confidence risk, time horizon risk, inflation risk, business cycle risk and market timing risk. The intuition behind these variables is presented in the previous section. The main problem we face at this point, is the estimation of confidence risk (or default risk) because of the non-existence of long-term corporate bonds in the Greek capital market, for the period under consideration. However, we achieve to override this obstacle by expressing default risk in an alternative way (see below).

In addition, we choose real retail sales as a proxy for business cycle risk instead of industrial production that was used by Chen, Roll and Ross (1984) for two reasons. Firstly, GDP growth during the last years has been based mostly on services, not on industrial production. So, we believe that industrial production underestimates the rise in real business activity. Furthermore, a considerable part of the firms contained in our sample, belongs to the retailing sector. Our point of view here is that changes in real retail sales are the appropriate measure of changes in real income. Next, it follows a short description of the macroeconomic variables, selected as the common pervasive risk factors and the methods of their estimation.

The spread between lending rates (prime rates) and deposit rates is the first risk factor employed in our study as a proxy for confidence risk. Unexpected changes in risk premia should affect the rates at which future cash flows are discounted by investors. It is evident that stock prices will be influenced if investors require a different compensation for buying a more risky instrument like equities. If LENDt denotes lending rates and DEPt denotes deposit rates at time t, then default risk DEFt is calculated from the equation

$$DEF(t) = \text{Log } LEND(t) - \text{Log } DEP(t)$$

Retail sales are the second macroeconomic variable and represent the business cycle risk. The unexpected changes in the growth rate of real final sales are used as a proxy for the unexpected changes in long-run profits for the economy. It is apparent that economic growth influences corporate profits and the size of future cash flows of equities. In order to obtain real retail sales, we deflate this series with the inflation rate. If RS(t) denotes real retail sales in month t, then the monthly rate of change denoted as RET is estimated as the logarithmic difference of real retail sales between two successive months.

RET(t) = Log RET(t) – Log RET(t-1)

Inflation rate represents the inflation risk in our study. To be more precise, we assume that unexpected changes in inflation will affect stock return by changing discount rates of cash flows. Monthly inflation rates at period t can be measured from the realized monthly first difference in the logarithm of the Consumer Price Index for period t.

INF(t) = log(CPI(t)) – log(CPI(t-1)) ,

In contrast, we have chosen to take advantage of the official monthly inflation rates available from the National Service of Greece. As a consequence, the economic series that is used for the estimation of unexpected inflation, described next in this section, is simply derived from the following equation:

INF(t) = Log(INF(t))

Term structure is the third risk factor used in our study and represents time horizon risk. It is measured as the return on a long-term government bond minus the return on a one-month Greek T-bill. A fall in the spread between a long term and a short- term government bond is a sign that investors require lower compensation for holding investments with longer maturity. If LGB(t) denotes returns on long-term bonds at month t and TB(t) returns on short-term bond at month t, then term structure TS(t) at month t will be determined as

UTS(t) = LGB(t) – TB(t).

At this point, we should mention that we have used bonds with maturity shorter than ten years for the first three years of our test period, since the issuance of 10-year bonds has been started after 1997.

Market portfolio itself is the last economic factor considered affecting stock returns. This factor represents market timing risk. The intuition here is that if the aforementioned four influences do not capture all of the macroeconomic and psychological factors that affects stock prices, then there may be an impact of the market itself. As a proxy for the Greek stock market we will use the Composite Index. Market-timing risk is computed as that part of the return of the Composite Index that is not explained by the first four macroeconomic risks and an intercept. To obtain this variable we will run a regression of the Composite index on the four variables discussed above. Our variable is simply the difference between the excess return on the market and the excess return predicted from the estimated economic variables discussed previously. The series that represents market timing risk will be derived from the following equation.

$$Rm = (MKT - Rf) - (b_o + b_1\,DEF + b_2\,INF + b_3\,RET + b_4\,TS)$$

3.2 ESTIMATION OF FACTOR SURPRISES

One of the most crucial issues in this study is the selection of the stochastic process that may generate the observed set of data of the macroeconomic variables. To be more precise, our intention is the estimation of a generating process in order to use the generated residuals from it, as the unanticipated innovations of the economic factors. The fundamental assumption of our model is that stock prices react to news about the macroeconomic variables, which is unanticipated. Consequently, a restrictive condition is that unanticipated components should be mean-zero, serially uncorrelated white-noise processes. Accordingly, any expectation process must, at least, provide unanticipated components that satisfy these properties.

Many techniques have been employed extensively for the estimation of expectations generating process, such as autoregressive models, the Kalman Filter approach etc. In our study we use the vector autoregression framework. The reason is that the VAR framework will help us to take into account any inter-relationships amongst economic time series. It is clear that an unexpected change in inflation should have an immediate impact on interest rates. So, shocks in one macrovariable should cause shocks in the others too. We believe that the estimation of our risk factors from a VAR model is statistically correct and also a useful tool for the description of possible interactions among macrovariables that other techniques fail to do. It follows a short description of VAR model and the methodology employed for the estimation of the unanticipated components.

3.2.1 The origins of VAR models and their basic structure

VAR models are dynamic systems of equations that examine the inter-relationships between economic variables, using minimal assumptions about the underlying structure of the economy. They aim at providing good statistical representations of the past interactions between variables. The main development of VARs as a modeling tool was in early 1980s, originating from concerns about the validity of some of the assumptions used in traditional macroeconometric models. In particular, Sims (1980) argued that the restrictions used to identify the parameters in traditional models, which often took the form of excluding variables or their lags from equations or assuming that a particular variable was exogenous, were incredible. He contended that theory was rarely sufficiently well defined to justify such exclusion restrictions and that such models were likely to be under-identified, once these problems were taken into account. As a result, some of the economic interpretations drawn from such models were unlike to be robust. These concerns led to the development of vector autoregressive models as an alternative modeling approach

Each economic variable in the system depends on past movements in that variable and all the other variables in the system. In contrast with traditional models, basic VAR systems make few assumptions about the underlying structure of the economy and instead of focusing entirely on deriving good statistical representation of the past interactions between economic variables, they let the data to determine the model.

Within a vector autoregressive model, variables are regressed on a constant and p lags of their own as well as p lags of all the other variables in the system. The validity of the VAR analysis depends on the stationarity of the time series (the theoretical content of stationarity is described below). This implies that the time series should have no trends or seasonal patterns. Economic time series often have to be transformed before these properties hold. In addition we need to check for units roots. If the observed values of an economic variable can be described by a unit root process then the variance of that variable goes to infinity, as t goes to infinity. This problem, however, is easily solved by taking the first differences or by a co-integration transformation of our variables.

.

A VAR system can be expressed in the following form

$$Z_t = A_1Z_{t-1} + A_2Z_{t-2} + \dots\dots + A_pZ_{t-p} + \varepsilon_t$$

where Z_t is a vector of endogenous variables at time t, A_i (I=1,....,p) are coefficients vectors, p is the number of lags included in the system and ε_t is a vector of residuals. The residuals, ε_t , represent the unexplained movements in the variables, reflecting the influence of exogenous shocks.

We have mentioned above that stationarity is a very useful statistical property in the estimation of a vector autoregressive model. If the stationarity assumption holds, then a VAR model may be adequate candidate for modeling the data-generation process. We will call a time series stationary when it has a constant mean and a finite variance. More formally a stochastic process y_t is stationary if

i) $E[y_t] = \mu$ for all t
ii) $var(y_t) < \infty$ for all t
iii) $cov(y_t, y_{t+k}) = E(y_t - \mu)(y_{t+k} - \mu) = \gamma_k$ for all t and k

It is worth noting that for k=0, condition (iii) implies of course that $var(y_t)$ is time invariant. Moreover a stationary process exhibits mean reversion in that it fluctuates around a constant long-run mean and has a theoretical correlogram that diminishes as lag length increases. On the other hand, a non-stationary series has permanent components. More specifically the mean and the variance are time-dependent and the autocorrelations die out slowly. It is evident that stationarity is an important statistical property, as it guarantees that there are no fundamental changes in the structure of time series.

Stationarity is one of the basic assumptions of a VAR model. Many economic time series demonstrate trends and seasonal patterns that cannot be captured by a stationary model. VAR models can be applied, if non-stationarity can be removed by transforming the series. The usual way to obtain stationary series is by taking differences and/or logarithms. The main argument against differencing is that it throws away information concerning the co-movements in the data.

Alternatively, we can estimate a vector error correction model (VEC), which can be regarded as a restricted VAR model. The advantage of this model is that allows the determination of the inter-relationships among non-stationary economic series, without transforming them into stationary. In this sense, it helps us to detect the interactions among economic variables that are closer to economic reality. In contrast, an unrestricted VAR model aims at providing just a good statistical representation of the inter-relationships between variables.

VEC models are based on the concept that there can be a linear combination of two or more non-stationary series that may be stationary. This stationary linear combination is called the co-integrating equation and can be interpreted as a long-run equilibrium relationship between variables. But what is integration? If a non-stationary series is transformed into a stationary one by differencing once, then this series is integrated of order 1. It is essential to mention that VEC models necessitate the variables to be integrated of the same order. To determine whether our macroeconomic series are co-integrated we will perform a Johansen' test.

3.2.2. Derivation of risk factors

The first step in our analysis is to test our economic series for unit roots. The existence of unit roots in our data is a signal of non-stationarity. We will perform the well-known Augmented Dickey-Fuller (ADF) test in order to specify the number of unit roots. By plotting our economic series, we will be able to determine whether we should include a constant, a constant and a linear trend or neither in the ADF test. The choice is important since the distribution of the test statistic under the null hypothesis differs among these three options. Furthermore we will examine the correlogram of each variable and estimate partial autocorrelations up to 12 lags and a standard Ljung-Box Q-statistic at lag 24. These tests will give us more information about the existence of stationarity in our series.

In case we detect unit roots (this is the most probable case) we proceed with our analysis by assessing the order of integration of our macrovariables. This is done by taking the first difference and check for unit roots. After this, we estimate a vector autoregression model using the undifferenced data to determine the lag length, which we are going to use in Johansen's test. The latter will specify any co-integrating relationships among our series. In case that cointegration exists, we will proceed with the estimation of a VEC model. Otherwise, we will differentiate our data in order to obtain stationarity and estimate a VAR model.

A crucial point in the VAR framework is the determination of the appropriate lag length. Our intention is to construct a parsimonious vector autoregressive model. We will use two criteria for the VAR order selection; the Akaike Information Criteria (AIC) and the Schwartz Criteria (SC). The order p is chosen so that AIC or SC criterion is minimized.

After selecting the appropriate lag length a VAR model will be estimated. The residuals of our economic variables will be regarded as the unexpected changes in risk factors and employed in our study as a proxy for systematic risk. In addition, this vector autoregressive model will help us to obtain ex-post forecasts of risk factors, which will be used in portfolio management in the last section of this work.

3.3 ESTIMATION OF FACTOR LOADINGS

In this step of our study we attempt to estimate a multi-index model based on the principles of Arbitrage Pricing Theory for the Greek stock market. The procedure for the estimation of the factor betas of the economic factors is based in part on the Fama – McBeth (1973) two-pass approach. To be more specific we restrict our analysis only on the first step of their procedure. We construct 32 well-diversified portfolios and we run 32 OLS time-series regressions for the period July 1997-August 2001 to estimate the sensitivity of portfolio returns to the systematic risk factors:

$$r_{it} = a_0 + \beta_{i1} \times f_{1t} + ... + \beta_{i5} \times f_{5t} + \varepsilon_{it} \quad (1)$$ where,

r_{pt} = the realized return on portfolio p in month t, p= 1,2 ,....,32, t= 1,2 ,...50.
a_0 = the intercept for the portfolio p
β_{pj} = the factor beta for portfolio p on factor j
f_{jt} = the unexpected change in the economic variable j in month t
ε_{pt} = the residual error for portfolio p in month t

The above equation represents our multi-index model that will be used for active and passive portfolio management in the last section of this study. The independent variables f_{jt} are the five economic factors estimated from the VAR model. We also estimate the coefficients of determination R^2 to detect the explanatory power of our risk factors. By forming portfolios we want to ensure that only systematic risks factors affect stock returns and have a more distinct of the general influence of the five risk factors on stock returns.

In order to implement our tests we construct twenty-five equally weighted portfolios, each one consisted of twenty-five randomly selected stocks and seven industrial portfolios. In the formation of the first twenty-five random portfolios, we face the problem of the limited number of securities available in our sample, but we overcome this obstacle by using each security in five different portfolios, each one formed with different criteria. In other words, equities are divided into groups according to five criteria, which are: 1) the Greek alphabetical order 2) entry date in ASE 3) market capitalization 4) price-to-earnings ratio (P/E) and 5) stock sensitivity to market portfolio, as it is measured by the Composite Index of ASE.

A theoretical background does not characterize the first two criteria and their purpose is to lead to a random formation of portfolios. The third one, firm size is used by Chen, Roll and Ross. We form portfolios on the basis of firm size to achieve the desired dispersion, without biasing the tests of the economic variables.

For the same reason, we use P/E ratio and market beta as criteria for the classification of equities into groups. Price-to earnings ratios are available from the Press and stock sensitivities to the market portfolio are calculated for the period 1999-2001 on a monthly basis. We rank stocks from these with the higher P/E stock to those with the lower ratio, hoping to divide securities in two categories, income and growth stocks. Furthermore, we construct portfolios based on market beta to obtain groups with different degree of volatility.

Finally, we create seven industrial portfolios. Each portfolio consists of firms that demonstrate similar characteristics and business activity and belong in the same sectors. Chen and Jordan (1993) and King (1966) employed this criterion, so as to focus on major inter-industry differences in risk and return. The average size of these portfolios is approximately 20 with a minimum of 8 and a maximum of 33 securities.

Then we estimate the sensitivity of the individual securities included in our sample to the five risk factors by running a OLS time-series regression for each one (see equation 1). The test period extends from July 1997 to August 2001 (50 months). We use 160 securities listed on the Athens Stock Exchange until June 1997, after removing firms with low volume of transaction or/and economic losses. The derived factor betas will be used in portfolio management. The same technique is employed to estimate the risk exposures (betas) of the main stock indices of the Athens Stock Exchange, which will be used as the benchmark portfolios in the application of our model in active and passive portfolio management.

3.4: USE OF THE MULTI-INDEX MODEL IN PORTFOLIO MANAGEMENT

The next step in our study is the application of our multi-index model, created in the previous steps, in active and passive portfolio management. Active management involves making bets about some risk factors in the sense of designing a portfolio with different risk exposure profile than a market index and trying to gain from economic surprises. An active and aggressive portfolio strategy is tilting. Starting from a normal portfolio (i.e. a benchmark or target portfolio), an investor may wish to deviate from this portfolio in a controlled way. By tuning the sensitivity coefficients, a specific risk profile of the investment portfolio can be chosen.

In contrast to aggressive strategies, defensive strategies do not require factor forecasts. Here, risk is considered as a threat, not as an opportunity and defensive strategies intend to shield a portfolio’s return from undesired factor influences. A passive defensive strategy is risk sterilization: a portfolio’s composition is shifted in order to mitigate or negate factor exposures that are considered to be excessive.

An active defensive strategy is hedging: a portfolio's risk exposure is structured in accordance with the risk preferences of the investor. The most common passive management is to hold a portfolio of stocks that closely tracks selected index. Keeping the above introduction in mind, we will try to examine the applicability of our multi-index model in portfolio management by performing the following tasks:

Creation of Index Portfolios: We are going to form index portfolios designed to track particularly well-diversified benchmark portfolios, such as the Composite ASE index. A tracking portfolio can be constructed simply by forming a portfolio with a matching risk exposure profile. By solving a quadratic-programming problem we will try to form portfolios that matched the risk exposure profile of a variety of stock indices as close as possible. As benchmark portfolios we are going to use the Composite ASE Index, the FTSE-20, the MSCI Greece Index, the Banking Index, the Industrial Index and the Construction Index.

Tilting or Making Factor Bets: Our goal here is to form groups of securities that, while closely tracking a target stock index, will also produce a return in excess of that index. For example, if we believe that inflation will fall more than the analysts predict we can allow a greater risk exposure to inflation risk by choosing stocks that are positively affected by this variable, without changing any other macroeconomic risks. In other words we will try to take advantage of favorable unexpected changes in risk factors by choosing securities with greater sensitivity to them or sterilize our portfolios by selecting equities with low risk exposure, in the opposite case. Ex-post forecasts of these factors will be generated from our VAR model for two separate months (October and November 2001) and according to them we will adopt the appropriate strategy to outperform the market. The portfolio formation is an optimization problem, easily solved by using linear programming

3.5 EVALUATION OF PORTFOLIO PERFORMANCE

In the last section of our study we will evaluate the performance of the index portfolios, constructed in such a way that they will achieve higher yield in comparison to our benchmark portfolios. It is apparent that the evaluation of portfolio performance must take into account not only the rate of return achieved but also the level of risk assumed. In other words, we should focus our attention on risk –adjusted returns.

There are three indices of performance for the evaluation of our investment strategy: a) the Sharpe ratio b) the Treynor ratio and c) the Jensen ratio. From these measures, we have decided to use the Sharpe ratio because it takes into the part of total risk that is due to imperfect diversification in comparison to the Treynor ratio that relates excess returns to the systematic risk, which is assumed to be predetermined in our tests.

The Sharpe ratio, which is named as ‘reward-to-variability R/V’ ratio, is defined as $SR = \frac{R_P - R_F}{\sigma(R_p)}$, where Rp is the rate of return of the portfolio, Rf the riskless interest rate and σ(Rp) the standard deviation of the portfolio’s rates of return. The numerator Rp-Rf represents excess return (or risk premium) for assuming risk. The denominator measures the degree of risk assumed by investors. So the Sharpe ratio measures the excess return per unit of total risk.

But if total portfolio returns are negative (this is our case in passive portfolio management), the Sharpe’s ratio becomes meaningless, since it will measure negative excess return per unit of total risk. In this case, we will compute risk-adjusted returns (RAR) simply as the ratio of total portfolio return to overall portfolio risk [RAR=Rp/σ(Rp)]. In other words, we will estimate portfolio overall return per unit of total risk. Because of the short investment period, we compute portfolio risk from the standard deviation of daily returns from their mean. If the value of the risk-adjusted returns of the generated portfolios exceed that of the target indices (in algebraic values), then we would conclude that we have managed to outperform the stock market and our multi-index might be successfully used in portfolio management.

3.6 DATA

The basic data consist of monthly returns from 160 stocks listed on the Athens Stock Exchange for the period July 1997 to August 2001. To be included in the sample, securities have to satisfy two criteria: a) they shouldn’t have been under surveillance during the aforementioned time period and b) to grow steadily and present a considerable volume of transactions. Moreover we exclude the stocks of financial firms from our sample, since their performance is obviously affected by the stock market. Data of the stock prices and the main stock indices are available from the database EFFECT FINANCE. It should be mentioned here that we use the adjusted stock prices as they are calculated from EFFECT FINANCE. Market capitalization and price-to-earnings ratios of equities are available from the Press. We estimate the monthly returns of securities because most macroeconomic data are only available at best on a monthly basis. Monthly returns are calculated by taking the logarithmic difference between the last observed stock price at the end of each month. As a proxy for the risk-free rate, we employ the Greek Treasury-bill rate, as it is given by the DATASTREAM.

In panel A of table 3.1, the basic data and the sources are described. The construction of the basic economic series employed in our analysis, the notation and the data measurement is described in panel B of the same table

TABLE 3.1

Panel A: Basic Series

Symbol	Variable	Data source or measurement
INF	Inflation	Monthly inflation rates (National Statistical Service of Greece)
LTGB	Long-term government bonds	Monthly rates of return on a 1-year government bond (1994-1997) and a 10-year long-term government bond (1997-2001); Datastream, National Bank of Greece
TB	Treasury-bill rate	Monthly rates of return on the Greek Treasury-bill rate (1994-2001), expressed in annual basis; Datastream
RET	Real retail sales	Retail sales during month, seasonally adjusted (1994-2001) and deflated by the GDP deflator ; Datastream
LEND	Lending rate	Monthly lending rates (prime rates) for the period 1994-2001; Datastream
DEP	Deposit rate	Monthly deposit rates for the period 1994-2001; Datastream
RM	Stock market returns	**Monthly returns on the Composite Index –60 of the Athens Stock Exchange for the period 1994-2001; Datastream**

Panel B: Derived Series

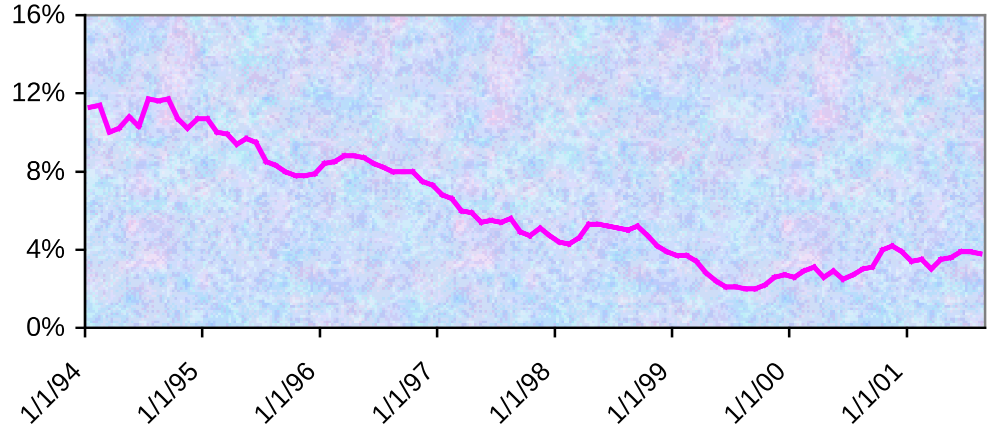
Symbol	Variable	Data measurement
INF	Monthly inflation rate	Log(INFt)
TS	Change in Term Structure	Log(LTGBt) – Log(TBt)
DEF	Change in risk premium	Log(LENDt) – Log(DEPt)
RET	Monthly change in retail sales	Log(RETt / RETt-1)
Rm	Stock market returns	Log(RMt / RMt-1)
Rf	Risk-free rate	**Greek Treasury-bill rate, expressed in monthly basis**
Rm-Rf	Excess return on the stock market	(Returns on ASE-60 – Risk-free rate)

Macroeconomic series are obtained from DATASTREAM, BLOOMBERG and the National Statistical Service of Greece for the period 1994-2001. Data for the economic variables cover a longer time period than this concerning the individuals firms, because VAR analysis requires obtaining economic data, three year prior to the test period. In order to obtain real retail sales, we deflate the nominal sales with GDP deflator. We avoid estimating inflation by taking the first logarithmic difference of the consecutive observations of the Consumer Price Index directly, but we employ the official estimations published by the National Statistical Service of Greece. Changes in term structure are calculated as the difference between the return on a long-term government bond and one-month Treasury bill. We have found some difficulty to calculate this series, since there wasn't available data for any Greek government bond with maturity greater than 1 year before 1997. For this reason, we have decided to use the returns of one- year Treasury bill for the period 1994-1997. It is very interesting to discuss the determination of default risk. This risk factor is calculated from the difference between the lending rates and deposit rates, in the same time period. We have chosen to adopt this definition of risk premium in order to overcome the problem of the non-existence of long-term corporate non-convertible bonds in the Greek economy before 1999.

The length of time covered (50 months) includes the great boom of the Greek stock market during 1999 and its expected correction during 2000 and the first semester of 2001. During this period, the Greek economy has grown faster than the other participant countries in the EU and the economic policy aimed at the reduction of public debt and the harnessing of inflationary pressures. Within this favorable macroeconomic outlook, the Greek stock market has positively been affected. Important role in the explosive rise of stock prices in 1999 has played the assignment of the Olympics Games of 2004 to Athens and of course the forthcoming entry of Greece into the euro area. These comments will become more discernible if we look at the diagrams which plots the course of inflation, interest rates, real retail sales and the Composite Index of the ASE during the sample period.

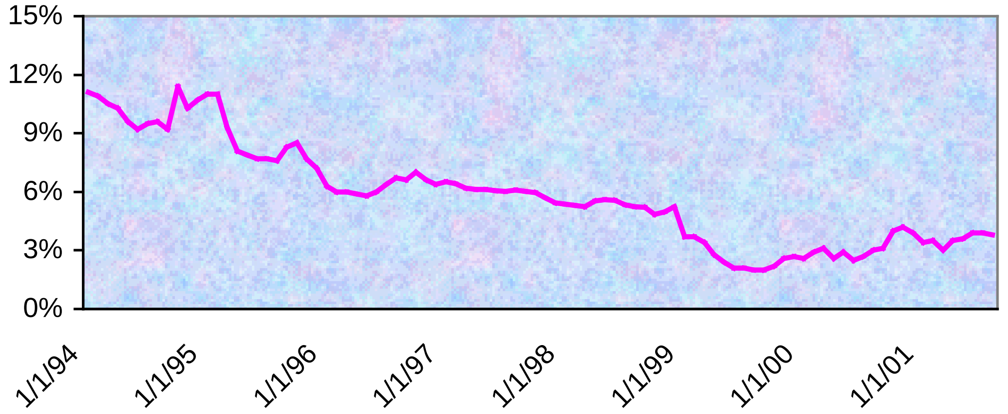
Figure 3.1 presents the course of inflation rate in the period 1994-2001. It is obvious the radical fall in the inflation rate, due to the successful restrictive economic policy that the Greek government has adopted in order to fulfil one the basic convergence criteria.

Figure 3.1: Inflation rate



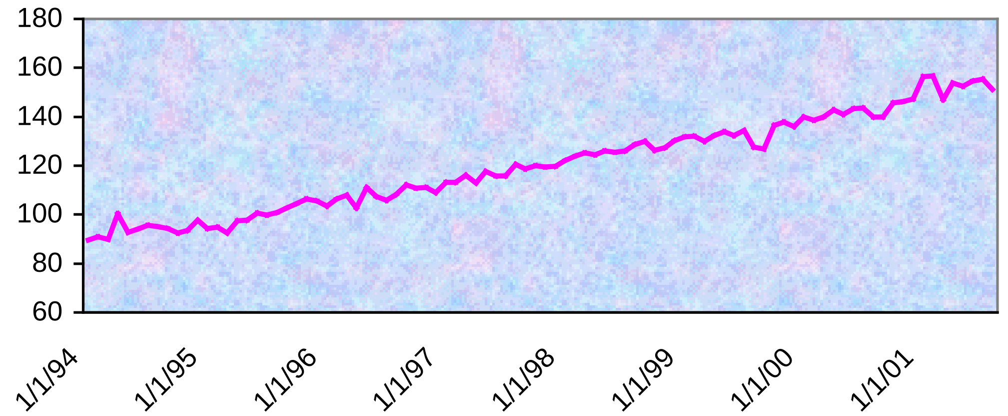
Price stability has permitted the fall of interest rates, although the Bank of Greece has restrained the pace of this decrease. The substantial decline in the 10-year bond yields (see figure 3.2) led to the attainment of the relevant Maastricht criterion.

Figure 3.2: 10-year bond yields



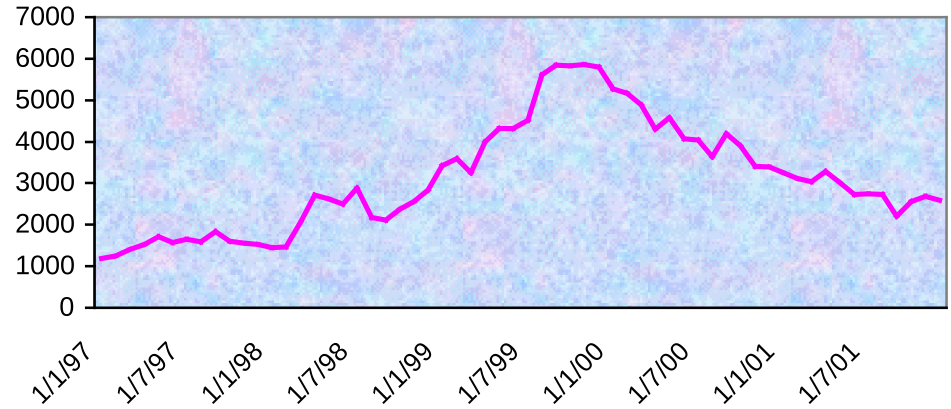
Greek economy grew at a robust pace during 1994-2001. If we consider real retail sales as a measure of the performance of the economy in the last seven years, then its course, as it is presented in figure 3.3, reveals the marked GDP growth in excess of the other European countries.

Figure 3.3: Retail sales (index)



The Greek stock market experienced two diametrically opposed phases. The first started in the summer of 1998 and lasted until September 1999. During this period, share prices and trading volumes in the Athens Stock Exchange (ASE) climbed at spectacular rates. Robust company results, the favorable economic conditions and the entry of a large number of new investors backed the impressive rise in stock performance. The expected reductions in Greek interest rates to euro-area levels boosted the discounted value of expected future earnings and as a result stock prices. But after September 1999, a violent and radical correction of the stock values started, as a result of the previous exaggerating rise. Although the economy has kept growing steadily, Greek stock market suffered significant losses, mainly because of the investor's pessimism and the economic deceleration in the United States and Europe. Figure 3.4 illustrates the course of the Greek stock market during the period 1997-2001.

Figure 3.4: The Composite Index ASE-60



SECTION 4

ESTIMATION OF UNOBSERVED COMPONENTS

4.1 INTRODUCTION

The construction of the generating process of the unexpected components of economic variables, which are used in the specification of a multi-index based on the principles of arbitrage pricing theory, is one of the most crucial parts in this analysis. That is because the use of an inappropriate technique may lead to false inferences regarding the statistical significance of estimated risk premia.

To date, three techniques have been employed extensively. The first one is the simple rate of change. This technique was used by Chen, Roll and Ross (1986) and is based on the premise that economic factors follow a random walk process. So, the unexpected changes in risk factors are simply considered to be the first difference between the actual values in two successive time periods. The basis of their argument is that monthly changes in macrovariables are nearly serially uncorrelated and they can be employed as innovations without alterations. The main drawback of this method is that ignores observations beyond the last one and furthermore, economic series generated from this method demonstrates significant autocorrelation.

The second technique, used as the generating process of unexpected changes, is autoregressive models. Chen and Jordan (1993) found that a first-order autoregressive model appears adequate to play the role of the data generating process and the residuals from this process can be used as the proxy for unanticipated components. Moreover, they argued that this method provide serially uncorrelated series of risk factors.

Finally, Priestley (1996) used an alternative way to estimate an expectation generating process of macrovariables, Kalman Filter. The basic principle of this method is that investors learn from their errors in forecasting economic variables and update their expectations recursively in each period, as more information becomes available. Priestley found that innovations generated from the Kalman Filter provide a better description of actual returns than the former techniques.

In this study, we adopt an alternative method to estimate the unanticipated components of economic variables, selected to be the pervasive risk factors. By accepting the fact that economic series are better described by an autoregressive process, we estimate a Vector Autoregressive Model (VAR). The residuals, generated for each macrovariable, will be used as the unanticipated changes in economic factors that affect stock prices. It should be mentioned that these residual series should be white noise processes, as theory demands. The construction of a VAR model is adopted because it takes into account the interactions among past values of economic variables, that other studies have failed to achieve. In the rest part of this section, the procedure of the estimation of unanticipated changes in risk factors is described in detail.

4.2. STATISTICAL PROPERTIES OF ECONOMIC FACTORS

The first step is to plot economic series to detect whether or not stationarity exists. A glance at the diagrams of our macrovariables will give us vital information about their generating process and its statistical properties, such as the autocorrelation function, the mean and the variance. The diagrams of our four macrovariables [default risk (DEF),), inflation rate (INF), real retail sales (RET), term structure (TS] are illustrated in the next figure.

Figure 4.1: The time plot of economic series

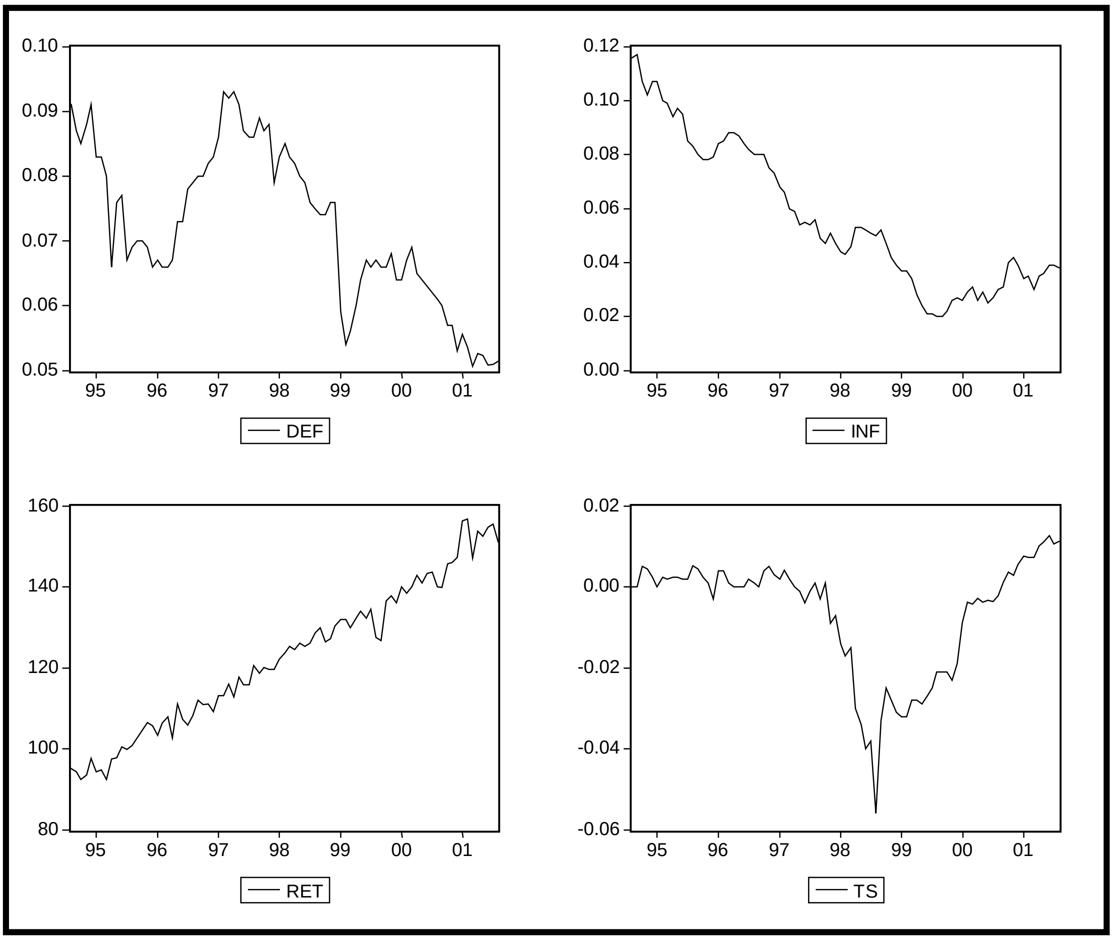


Figure 4.1 illustrates the behavior of the four macrovariables regarded as the pervasive risk factors in our analysis. This pattern reveals that our economic time series are not stationary. These series do not seem to be mean reverted and sample means to be constant. In addition, we can see that economic series exhibit an obvious trend or drift throughout the period August 1994 – August 2001.

Real retail sales and inflation rates exhibit an upward and a downward linear time trend respectively and increase or decrease systematically as time increases. We can characterize them as ‘random walk’ processes with a drift and trend. On the other hand, risk premia and term structure neither exhibits such an intensive trend nor seems to be mean-reverted. Risk premia fell during the course of time. Term structure declined rapidly during mid 1997-mid 1999 and later recovered back to the level of 1995. We can assume then that these two processes are not stationary since they are not mean reverted.

Table 4.1 displays the correlation coefficient among the relevant macrovariables. Cross-correlation among our economic series is a very important statistical characteristic since theory suggests that our variables be orthogonal.

Table 4.1: Correlation matrix for economic variables

Series	DEF	INF	RET	TS
DEF	1			
INF	0,517	1		
RET	-0,680	-0,890	1	
TS	-0,033	0,398	-0,167	1

Note: DEF – risk premia or default risk (lending rates – deposit rates). INF- inflation rate, RET- real retail sales, TS- term structure (long-term government bond return-T-bill rate)

It is evident from Table 4.1 that our economic series display important cross-correlations. The strongest inter-relationship is between inflation and real retail sales. The negative sign is expected since the Greek economy has grown rapidly within the last years and inflation has declined in the same period. Moreover there is a considerably positive relationship between inflation rates and interest rates series. This is to be expected since deflation has allowed the narrowness of the spread between returns on risky and safe assets, long-term and short-term investments. An important point is the weak relationship between risk premia and term structure. In fact, they seem to be uncorrelated and this finding it may be caused by the way of specifying risk premia in this study. From the aforementioned, it is apparent that our factors are not orthogonal and the problem of multi-collinearity will lead to the imprecision of the parameter estimates of the multi-index model. The solution will be the transformation of our economic series in order to obtain orthogonality.

Table 4.2 displays autocorrelations up to lag 12 and Q-statistic at lag 24 and table 4.3 partial autocorrelations up to lag 12. These characteristics will indicate the existence of unit roots in our macrovariables. If our series are serially correlated then they will not be stationary and need to be transformed before being employed in our tests. Furthermore, theory suggests that economic factors should be serially uncorrelated in order to regard their values as true shocks.

Table 4.2: Autocorrelations of the Economic Variables (July 1994-August 2001)

SERIES	DEF	INF	RET	TS
Lag 1	0.915	0.960	0.956	0.939

Lag 2	0.838	0.915	0.915	0.891
Lag 3	0.780	0.878	0.878	0.836
Lag 4	0.705	0.843	0.838	0.783
Lag 5	0.636	0.802	0.802	0.723
Lag 6	0.577	0.756	0.770	0.669
Lag 7	0.503	0.719	0.720	0.607
Lag 8	0.432	0.683	0.672	0.537
Lag 9	0.378	0.652	0.638	0.478
Lag 10	0.308	0.615	0.604	0.404
Lag 11	0.240	0.579	0.573	0.338
Lag 12	0.190	0.549	0.546	0.266
Ljung-Box Q-statistic (24)	385.67*	837.40*	805.34*	557.56*

Note: * indicates that Q-statistic is significant at the 1% level

Table 4.3: Partial autocorrelations of the economic variables (July 94-Aug 01)

SERIES	DEF	INF	RET	TS
Lag 1	0.915	0.960	0.956	0.939
Lag 2	0.006	-0.073	0.017	0.086
Lag 3	0.074	0.078	0.027	-0.081
Lag 4	-0.127	-0.001	-0.049	-0.020
Lag 5	0.000	-0.099	0.025	-0.087
Lag 6	0.001	-0.064	0.018	0.002
Lag 7	-0.111	0.068	-0.207	-0.077
Lag 8	-0.034	-0.017	-0.030	-0.136
Lag 9	0.037	0.049	0.136	0.044
Lag 10	-0.115	-0.077	-0.003	-0.141
Lag 11	-0.036	-0.011	0.001	-0.018
Lag 12	0.026	0.037	0.023	-0.078

As we can see from table 4.2, our economic series are highly autocorrelated, even at lag 12. The Box –Pierce Q-statistic indicates strong serial correlation at lag 24. It is apparent that autocorrelations taper off slowly and this is a signal of non-stationarity in our economic series.

Autocorrelation in economic series implies the existence of an errors-in-variables problem that will bias the estimates of the sensitivities of stock returns to these risk factors. For that, it is very important to remove autocorrelation from our data before using them in our tests.

As it is evident from Table 4.3, partial autocorrelations of our economic variables are very high at lag 1, but become quite insignificant after the first lag. This finding makes us assume that an autoregressive model of order 1 can describe efficiently the data generation process of economic series employed in this study.

But we should be aware that "eyeballing" the data is not a substitute for formally testing for the presence of non-stationary behavior. For this reason we employ the Augmented Dickey-Fuller test, to verify the presence of unit roots in our economic series. But this time, we take the logarithms of our time-series, in order to smooth the problem of different ways of measurement. The results of the ADF test are summarized in the following table.

Table 4.4: Results of Augmented Dickey-Fuller Test

	LEVEL		FIRST DIFFERENCE	
VARIABLES	T1	T2	T1	T2
DEF	-0,635	-1,642	-4,596*	-4,639*
INF	-1,309	-1,399	-5,312*	-5,350*
RET	-0,151	-3,094	-4,642*	-4,615*
TS	-0,842	-0,530	-5,727*	-5,952*

Note: * indicate significance at 1%. – T1 equation with intercept – T2 equation with trend and intercept.

The overall results suggest that all variables possess one unit root and by first differencing them we can obtain stationarity. Consequently, we conclude that these series are integrated of order 1 and they are likely to exhibit cointegration. In order to explore the existence of cointegration among our economic variables we employ a Johansen test. If our tests reveal cointegration in data, we will proceed with the construction of a Vector Error Correction (VEC) model, based on the levels of our series. Otherwise, we will estimate a VAR model and as endogenous variables we will use the first logarithmic difference of our macrovariables.

Because the results of a Johansen's test can be quite sensitive to the lag length, we will estimate a VAR model with undifferenced data, and its lag length will be used in the Johansen test. For the determination of the VAR order we take into account two criteria: Akaike and Schwarz. The results of these tests are listed in table 4.5.

Table 4.5: Determination of lag length for the Johansen test

Order p	Akaike Information Criteria	Schwarz Information Criteria
1	**560,838**	**561,386**
2	583,480	584,473
3	592,010	593,454

We estimate an unrestricted VAR model with a constant. As we can see from table 4.5, lag length 1 minimizes both the Akaike Information Criteria and the Schwarz Information Criteria and it will be used for the detection of cointegration relationships among our series. The E-views statistical package provides five alternatives options for the Johansen's test. We choose as the most suitable, the one that accepts intercept and trend in the cointegration equations (CE) and no trend in the VAR model (VAR uses differenced forms of data). This means that we adjust our cointegration test to allow for linear deterministic trend in data, as it is evident from their diagrams presented above. The implementation of the Johansen's test, for this option, shows that there isn't any cointegration relationship among our economic series. Johansen test is summarized in table 4.6.

Table 4.6: Results of cointegration tests (Johansen test)

Test assumption: Intercept and trend in CE – No trend in VAR				
Eigenvalue	Likelihood Ratio	Critical Value 5%	Critical Value 1%	Hypothesized No of CE(s)
0.339366	60,382	62.99	70.05	None
0.116889	22,658	42.44	48.45	At most 1

0.080243	11,346	25.32	30.45	At most 2
0.040209	3,735	12.25	16.26	At most 3

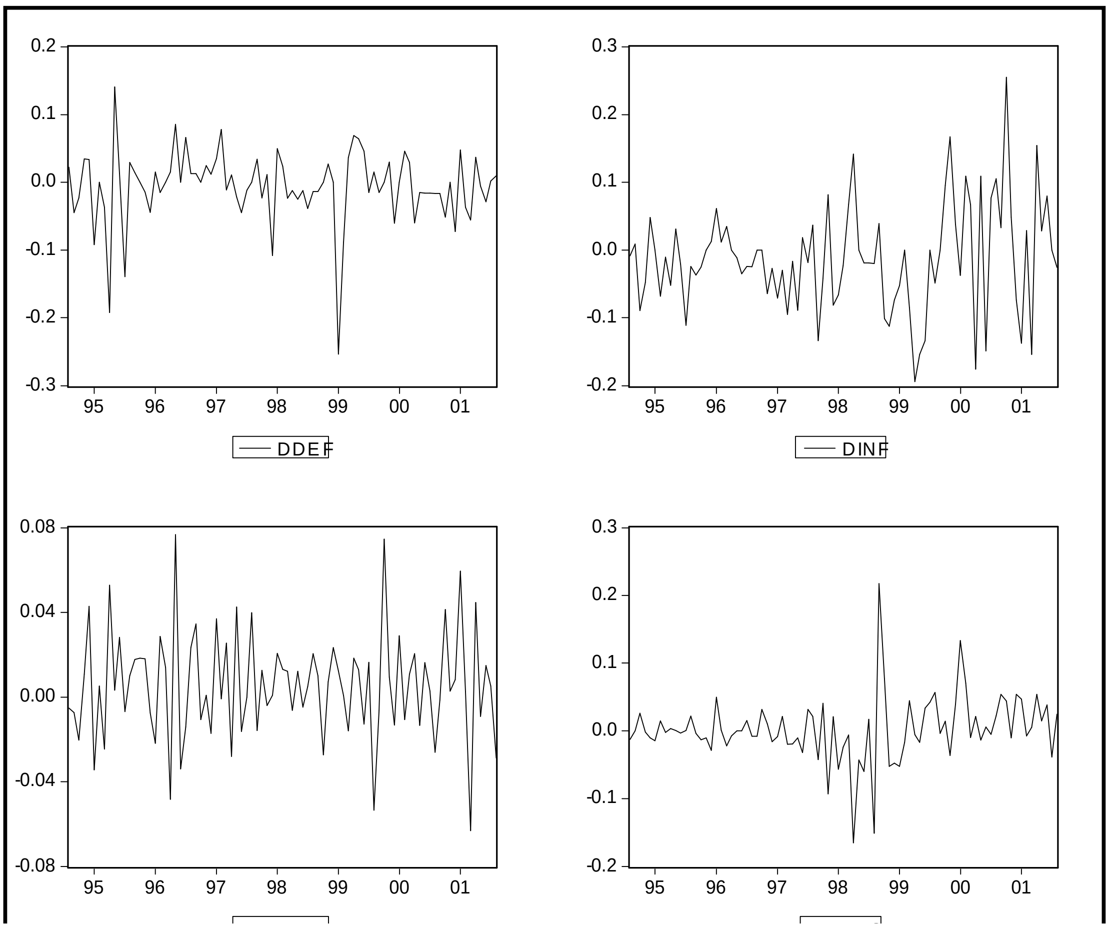
Note: * (**) denotes rejection of the hypothesis at 5% (1%) significance level-

Likelihood ratio rejects any cointegration at 5% significance level

4.3 ESTIMATION OF A VECTOR AUTOREGRESSIVE MODEL

Since there aren't any co-integrating relationships amongst our data, we take the first logarithmic difference of our series and estimate a VAR model. Figure 4.2 displays the time plot of our economic series from July 1994 to August 2001, after transforming them to obtain stationarity. It is evident that our processes are mean-reverted, with mean equal to zero. Autocorrelation is roughly obvious but we can detect heteroskedasticity in our data.

Figure 4.2: The time plot of the first-differenced logarithmic economic series



A drawback of VAR methodology is that it doesn't take into account the structure of economy but it rather provides a good statistical representation of the interactions between variables. In order to remove non-stationarity, economic series are transformed and these transformations may distort or eliminate the original relationship. To verify whether this argument is valid in our data, we perform a Granger-causality test and its results are listed in table 4.7.

Table 4.7: Results of the Granger causality test

Null Hypothesis:	**Lag 1**	Lag 2	Lag 6
	F-statistic	F-statistic	F-statistic
INF does not Granger Cause DEF	0.07348	0.06931	0.44522
DEF does not Granger Cause INF	0.00051	0.17919	0.91149
RET does not Granger Cause DEF	0.00064	0.15930	0.45749
DEF does not Granger Cause RET	219.074	119.316	0.72598
TS does not Granger Cause DEF	0.14273	0.10176	**205.039****
DEF does not Granger Cause TS	0.09720	0.19093	0.14878
RET does not Granger Cause INF	0.08554	0.44050	0.55680
INF does not Granger Cause RET	0.12145	0.06290	105.234
TS does not Granger Cause INF	0.07065	0.02965	0.31751
INF does not Granger Cause TS	0.00331	0.00706	0.46346
TS does not Granger Cause RET	159.987	0.87457	0.81032
RET does not Granger Cause TS	0.03042	**667.039***	**231.724***

Note: * denotes statistical significance at 5%- ** denotes statistical significance at 10%-

Table 4.7 reveals that there is very little support in favor of any causality between our economic variables, with the exception of retail sales and term structure. To be more specific, it seems that retail sales Granger-cause term structure under 2 and 6 months lags. Moreover, there is a weak relationship between term structure and risk premia in lag 6. These findings prove that economic interactions among our macrovariables are sacrificed in favor of stationarity. However, this conclusion will not discourage us from constructing a VAR model since our intention is to generate the unexpected changes in these series and not to study the economic relationships that rule them. In addition, the lack of strong interactions is not an undesirable property, since APT theory suggests that risk factors are orthogonal.

The selection of the appropriate lag length of the VAR model is the one that minimizes the Akaike Information Criteria and the Schwarz Information Criteria. We should mention here that the order of our model might not agree with the one suggested by the aforementioned criteria in case the risk factors derived from it doesn't exhibits the desirable statistical properties. Table 4.8 presents in details the Vector Autoregressive Model used further in our analysis.

Table 4.8: Vector Autoregressive Model (sample adjusted: July 1994-Aug 2001)

	DDEF	DINF	DRET	DTS
DDEF(-1)	-0.028951 (0.10673) (-0.27125)	-0.091736 (0.15432) (-0.59447)	0.088364* (0.04821) (-1.83273)	0.058710 (0.12776) (0.45953)
DDEF(-2)	- 0.245526*** (0.09702) (-2.53061)	0.090340 (0.14027) (0.64402)	-0.017122 (0.04383) (-0.39066)	-0.013166 (0.11614) (-0.11337)
DINF(-1)	-0.109572 (0.07566) (-1.44829)	0.133019 (0.10938) (-1.21608)	-0.035401 (0.03418) (-1.03583)	0.002765 (0.09056) (0.03054)
DINF(-2)	-0.007801 (0.07514) (-0.10382)	0.170387 (0.10863) (-1.56847)	0.043148 (0.03394) (-1.27124)	0.126245 (0.08994) (-1.40368)
DRET(-1)	-0.071359 (0.23674) (-0.30143)	0.190927 (0.34228) (0.55781)	-0.542908*** (0.10694) (-5.07667)	-0.005658 (0.28338) (-0.01997)
DRET(-2)	-0.089961 (0.23375) (-0.38486)	-0.631650* (0.33795) (-1.86905)	-0.306077*** (0.10559) (-2.89872)	-0.617011** (0.27980) (-2.20521)

DTS(-1)	0.199616** (0.08918) (-2.23840)	-0.077041 (0.12893) (-0.59752)	-0.008198 (0.04028) (-0.20350)	-0.249964** (0.10675) (-2.34167)
DTS(-2)	0.000913 (0.09167) (0.00996)	-0.010660 (0.13254) (-0.08043)	-0.026056 (0.04141) (-0.62922)	-0.052955 (0.10973) (-0.48259)
C	-0.006691 (0.00653) (-1.02476)	-0.005418 (0.00944) (-0.57395)	0.011262*** (0.00295) (-3.81839)	0.008696 (0.00782) (-1.11263)
R-squared	0.142215	0.116323	0.324928	0.157329
Adj. R-squared	0.057495	0.029046	0.258254	0.074103
Sum sq. resids	0.241947	0.505748	0.049371	0.346665
S.E. equation	0.054653	0.079018	0.024688	0.065420
Log likelihood	138.6437	105.4643	210.1645	122.4598
Akaike AIC	138.8437	105.6643	210.3645	122.6598
Schwarz SC	139.0937	105.9142	210.6145	122.9098
Mean dependent	-0.004049	-0.012207	0.005634	0.002416
S.D. dependent	0.056296	0.080191	0.028666	0.067988
Determinant Residual Covariance		3.10E-11		
Log Likelihood		578.0628		
Akaike Information Criteria		578.8628		
Schwarz Criteria		579.8628		

Note: Standard error and t-statistics in parenthesis- D denotes first logarithmic difference- * statistical significance at 10% - ** statistical significance at 5% - *** statistical significance at 1%.

The vector autoregression model listed in table 4.8 is estimated by the OLS method. This model is of order 2. It should be mentioned here that this lag length does not minimize the Akaike and the Scwharz Criteria, but we prefer it because it gives a better description of the interrelations amongst our variables. In a VAR model, the lagged values of each endogenous variable are used as the exogenous ones. The derived residuals represent the unexplained movements in the variables and reflect the influence of exogenous shocks. So, the residuals, generated from the estimated regressions within the VAR framework, will be regarded as the unexpected changes in risk factors that systematically affect stock returns and are used for the estimation of sensitivities of stock returns to them. The underlying assumption here is that the estimated model is the true model that describes shocks in economic variables.

It is very appealing to make some inferences from our VAR model. The first thing to mention is the low R-squared statistic and adjusted R-squared measure. Recall that these criteria measure the proportion of the total variance explained by the linear influence of the explanatory variables.

This result is mostly caused by the transformation of series to remove non-stationarity, which seems to distort the original economic relationships.

Inflation rate does not seem to be influenced neither by its lagged values nor by the other economic variables. The coefficient of multiple determination is too low whereas the adjusted R^2 is very close to zero. None of the estimated regression coefficients are statistical significant, except from the second lag of the first-differenced retail sales (significant at 10% level). It is logical to expect that unexpected changes in retail sales will influence inflation but the negative sign of this coefficient is very confusing.

Default risk is influenced by the second lag of itself and the term structure, with relatively high level of significance (1% and 5% respectively). The coefficient R^2 is higher compared to that of the inflation series, but the adjusted R^2 is very small.

In contrast, retail sales exhibit the higher degree of explanation from the VAR model. This series is strongly affected by the first lagged value of default risk and its two lagged values. Also, the constant term is appeared to be statistical significant at the 1% level and the R^2 coefficient is the largest within our variables.

Finally, the term structure is affected by retail sales at lag 2 and its own first lagged value, both at 5% statistical level of significance. As we have seen from the Granger causality tests, a significant relationship between these two macrovariables exists. However, the R-squared statistic measure is just 15% and that means that this series is not affected by the other variables.

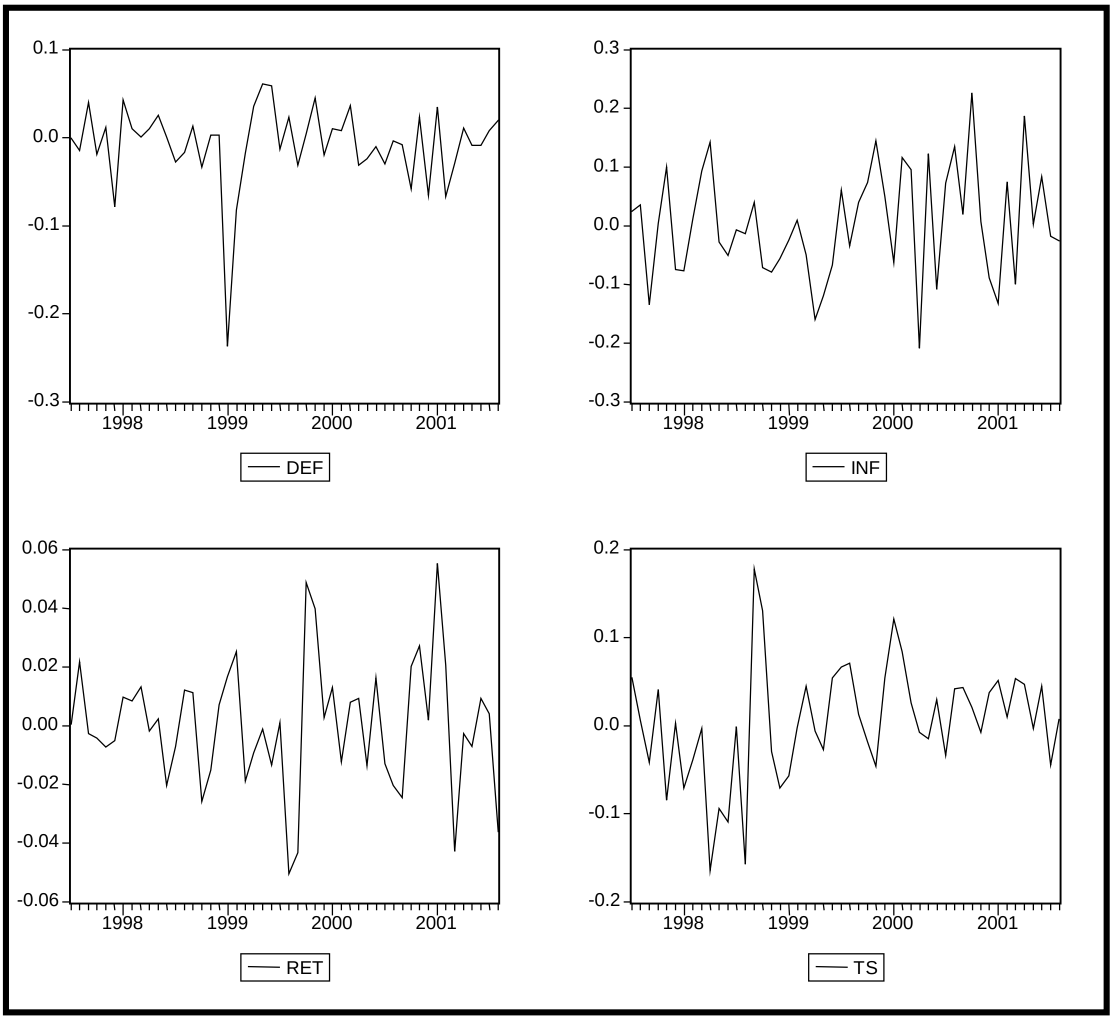
The basic conclusion, inferred from the above remarks, is that macrovariables seem to be independent of each other and this is caused by their transformation, which it was made for statistical purposes. But this not an undesired property, since it will simplify the selection of optimal portfolios.

The series of risk factors derived from VAR model covers seven years (Aug 1994-Aug 2001). In our tests though, we restrict the length of time to five years (July 1997 –August 2001). The reason is that the Athens Stock Exchange was a “thin” security market before 1997.

The picture changed in the second semester of 1997 when investors started to allocate their funds in favor of the stock market and the Composite ASE index rapidly rose, a tendency that continued for two more years. Consequently, the increased trading volumes and investors’ interest for the stock market reinforced the role of changes in macrovariables, as a source of systematic risk, and investment decisions became more sensitive to economic factors. So, we use data from mid 1997 to August 2001, in order to obtain more reliable estimations of the influence of unanticipated changes in economic factors on stock prices.

In the next part of this section, we present some tests of the statistical properties of our risk factors that should agree with theory. As it is noted in the previous section of this paper, our constructed factors should have mean equal to zero and be serially uncorrelated. Roll and Ross (1994) state that risk factors themselves may be cross-correlated. Figure 4.3 depicts the time plot of the economic variables employed in our analysis.

Figure 4.3: The time plot of systematic risk factors (July 1997-August 2001)



As we have noted before, risk factors should meet the assumption of zero-mean. From figure 4.3 we can see that our series fluctuates around zero and we can assume that they have zero means. In order to be sure, we carry out a simple hypothesis test regarding the mean and use t-statistic. We test the null hypothesis that the mean μ of the series is equal to zero against the two-sided alternative that is not equal to zero. The results of our tests for each of the indices are presented in table 4.9.

Table 4.9:Hypothesis testing for the sample mean of risk factors (July 97-Aug 01)

Hypothesis Testing for DEF			Hypothesis Testing for INF		
Test of Hypothesis: Mean = 0			Test of Hypothesis: Mean = 0		
Sample Mean = -0.007870			Sample Mean = 0.003661		
Sample Std. Dev. = 0.046468			Sample Std. Dev. = 0.093462		
Method	Value	Probability	Method	Value	Probability
t-statistic	-1.197635	0.2368	t-statistic	0.276955	0.7830
Hypothesis Testing for RET			**Hypothesis Testing for TS**		
Test of Hypothesis: Mean = 0			Test of Hypothesis: Mean = 0		
Sample Mean = 0.000135			Sample Mean = 0.003956		
Sample Std. Dev. = 0.021450			Sample Std. Dev. = 0.065790		
Method	Value	Probability	Method	Value	Probability
t-statistic	0.044432	0.9647	t-statistic	0.425137	0.6726

It is apparent that the null hypothesis of zero-mean is strongly accepted. The reported probability value is the marginal significance level. Only for the default risk, the possibility to accept the zero-mean hypothesis is not so great. So, the zero-mean assumption is satisfied here. The second condition to hold is the non-existence of serial correlation. Table 12 displays autocorrelations up to lag 12 and the Q-statistic at lag 24. Financial theory suggests that risk factors are uncorrelated across time so as to be considered as true shocks. This is a logical assumption since an unexpected change in a risk factor in one period should not generate shocks in the following periods.

Table 4.10: Autocorrelations of the Risk Factors (July 1997-August 2001)

SERIES	DEF	INF	RET	TS
Lag 1	0.087	-0.029	0.138	0.225
Lag 2	0.067	0.054	-0.276	0.092
Lag 3	-0.106	-0.041	-0.108	-0.037
Lag 4	-0.172	-0.099	-0.187	0.032
Lag 5	-0.100	0.042	0.096	0.075
Lag 6	0.029	-0.057	-0.062	0.077
Lag 7	0.002	-0.105	-0.194	0.142
Lag 8	-0.012	0.142	-0.013	0.015
Lag 9	-0.136	0.063	-0.043	0.137
Lag 10	-0.096	-0.054	0.037	-0.015
Lag 11	-0.089	0.135	0.110	0.041
Lag 12	-0.162	-0.126	0.111	-0.021
Ljung- Box Q-statistic (24)	13.394	12.461	28.368	16.027

Note: The approximate two standard error bounds are $\pm 0{,}282$

As we can see from table 4.10, the constructed risk factors are not significantly autocorrelated. The greatest serial autocorrelation appears in retail sales (lag 2) and term structure (lag 1). On the other hand, default risk and the inflation rate series exhibit the lower overall degree of autocorrelation. Recall that for a white-noise series the autocorrelations are zero. Thus, if we compare the estimated autocorrelations with the critical bounds we can conclude that they are not statistical significant and our VAR model seems to be very sufficient.

To check the overall acceptability of the assumption that our series are not correlated across time, we use the Ljung-Box Q-statistic. The Q-statistic is often used as a test of whether the data series are white noise. Here we have calculated Q-statistics at lag 24 and it is obvious that we can accept the null hypothesis that there is no autocorrelation up to this lag. All the Q-statistics are insignificant, especially for the series of default risk and inflation rate. Only for retail sales the Q-statistics is not so small and this is expected since autocorrelation in lag 2 is very close to the critical bounds. From these observations, we can argue that our risk factors are white-noise processes and the estimated VAR model is considered to be adequate.

Table 4.11: Covariance matrix for Risk Factors (July 1997-August 2001)

	DEF	INF	RET	TS
DEF	0.002116			
INF	-0.000250	0.008560		
RET	-3.80E-05	0.000218	0.000451	-0.000196
TS	2.11E-05	-2.55E-05	-0.000196	0.004242

Table 4.12: Correlation matrix for Risk Factors (July 1997-August 2001)

	DEF	INF	RET	TS
DEF	1.000			
INF	-0.058632	1.000		
RET	-0.038938	0.110834	1.000	
TS	0.007027	-0.004238	-0.141787	1.000

Table 4.11 exhibits the covariance matrix and table 4.12 the correlation matrix of our risk factors. The diagonal elements of the covariance matrix represent the factor variances. We display these two tables to examine the inter-relationships amongst our macrovariables. We should remind here that one of the assumptions of the multi-index model is that the indices are uncorrelated (orthogonal). Of course this not a restrictive condition since it is reasonable to expect the co-movement of economic variables.

If we take a look at the first table, we observe that the covariances between our series are very small and can be regarded as insignificant. The correlation matrix (table 4.12) supports the view that our macrovariables under consideration are far from being significantly correlated and can not be readily replaced with any other. The only considerable relationships exist between retail sales and inflation (+0,110) and retail sales and term structure (-0,141). The positive correlation between the first pair of macrovariables is sensible because economic activity causes increases in commodity prices. The negative correlation between retail sales and term structure is due to the fact that, when economy grows at a stable pace, investors prefer to invest in the long run and for this reason the difference between the returns on assets with different maturity decreases. The other cross-correlations are negligible and no variable can be substituted for any other. From the above analysis we conclude that our risk factors are orthogonal and the estimated VAR model has really generated factors with the desirable mathematical properties, required for the estimation of a multi-index model.

4.4 ESTIMATION OF MARKET TIMING RISK

The last risk factor that remains to be estimated is the market time risk and is computed as that part of the stock market total return that is not explained by the first four macrovariables described above. To obtain this variable we simply run a time-series regression of the Composite Index of the ASE (we assume that it represents the market portfolio) on the four factors estimated previously. The residuals generated from this regression are the last risk factor. We should mention here that the endogenous variable in this regression is the monthly excess return on the market Rm-Rf, where Rf is the risk free rate defined as the one-month Greek T-bill rate. We do not use a constant term because we find it to be statistically insignificant. By regressing the excess return of market on the four macrovariables we have computed the following results:

. **Table 4.13: Regression of the market index on the four economic risk factors**

$$MKT - Rf = -0{,}156DEF + 0{,}083INF - 1{,}300RET - 0{,}138TS \qquad (1)$$

(-0,39) (0,45) (-2,12) (-0,42)

R^2=0,06

t-values in parentheses

As we can see from equation 1, macrovariables explain only a small part of the total return of the Greek stock market. In addition, only retail sales are a statistically significant risk factor. The R-squared statistic is too small, indicating the low explanatory power of the estimated economic factors on stock market fluctuations. This result is mainly caused by the irrational behavior of the Greek stock market during the period of our tests. To be more specific, the Greek stock market experienced a great boom and a radical decline within 1997-2001. Investors made their investment decisions by taking into consideration mostly rumors and not the structural changes in the Greek economy. So, it seems logical to detect a weak relationship between unexpected changes in macroeconomic factors and stock returns, since investors' decisions were extremely affected by rumors and psychological factors. As it was referred in previous sections, market-timing risk measures the part of security returns variability owed to psychological factors.

Consequently, we are going to estimate a multi-index model, that in fact is a combination of a single index model (the market model), which accepts that security returns are affected by market changes, plus four macrovariables. It is obvious that we have split systematic risk into two sources; the first is the market itself and the second is changes in macroeconomic variables.

Therefore, the fifth variable employed, as a pervasive risk factor in our analysis, is simply the differences between the excess return on the market for any month and the excess return predicted from the estimated equation

$$Rm = (MKT – Rf) –(-0,156DEF + 0,083INF – 1,300RET – 0,138TS) \qquad (2)$$

where Rm denotes market-timing risk. This variable should be orthogonal to the others and this is proved if we look at the cross-correlations of market risk with the other risk factors, presented in table 4.14.

Table 4.14: Correlation matrix of RM

	DEF	INF	RET	TS
RM	0,004999	-0,001156	-0,000185	-0,001775

Recall that every risk factor should have means equal to zero. If we observe the time plot of market portfolio presented in figure 4.4, we can argue that this process is zero-mean reverted. Volatility decreases as time passes, and this is owing to the reduction of trading volumes after the crash of stock prices after 1999. Also, it seems that the series is serially correlated and this is a drawback of it. A t-statistic test of the zero-mean hypothesis for the market risk and for the period July 1997 to August 2001 is displayed in table 4.15.

Figure 4.4: The time plot of market-timing risk (July 1997-August 2001)

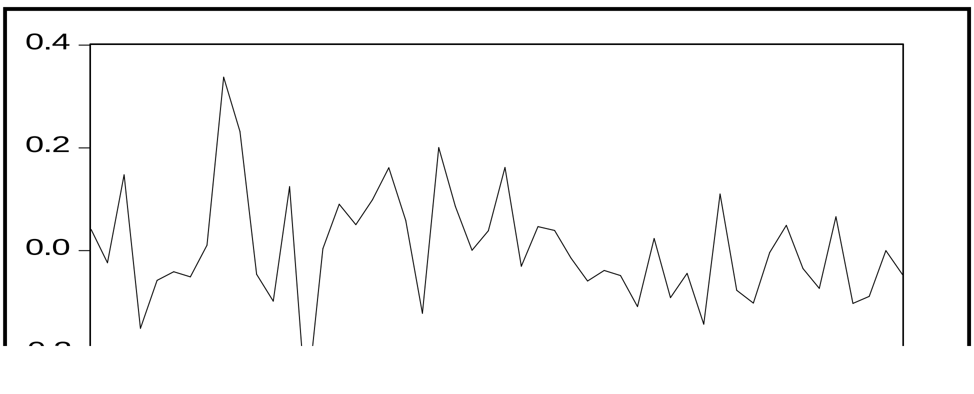


Table 4.15: Hypothesis testing for the sample mean of the market-timing risk

Hypothesis Testing for RM		
Test of Hypothesis: Mean = 0.000000		
Sample Mean = 0.003203		
Sample Std. Dev. = 0.110748		
Method: t-statistic	Value	Probability
	0,204537	0,8388

It is apparent that the null hypothesis of zero-mean is strongly accepted and for the market risk factor. The last test to perform for this variable is to check this series for autocorrelation. As we mentioned above, serial correlation across time is not a desirable statistical property. Table 4.16 displays the autocorrelations of market factor up to lag 12, from July 1997 to August 2001.

Table 4.16: Autocorrelation of Market factor

Lags	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
RM	0.049	-0.03	0.136	0.002	-0.29	0.126	0.320	-0.09	0.138	0.248	-0.17	-0.18

Note: The approximate two standard error bounds are $\pm 0,282$

As we can see from this table, serial correlation is marginally evident at lag 5 and lag 7. In the other lags, autocorrelation is negligible. This is due to the way of estimating this risk factor. Since, our data are not seriously autocorrelated, we can draw the conclusion that the problem of autocorrelation is not statistical significant and so, we can employ this variable in the estimation of a multi-index, presented in the next section of this paper.

SECTION 5

ESTIMATION OF MULTI-FACTOR MODEL

5.1 PORTFOLIO FORMATION

A crucial part in the procedure of constructing a multi-factor model, which describes the return generating process, is the estimation of factor loadings (the sensitivity of individual firms to common economic variables). It is known that, although many different firm-specific forces can influence the returns on any individual stock, these idiosyncratic effects tend to cancel out in large and well-diversified portfolios. By constructing portfolios, we ensure that only economic forces will influence systematically stock returns and therefore, obtain a more reliable general view of factor betas.

Our sample includes 125 securities listed on ASE before 1995 and a second group of 35 securities listed on the Greek stock market between January 1995 – June 1997. We have excluded from our sample investment companies, which are highly dependent on the market, and firms with low volume of transactions or being under suspension. In order to perform our tests, we divide the securities of the first group into 25 equally weighted portfolios, each one consisted of 25 stocks. Moreover, we form seven industrial portfolios by using the total number of securities (160). The firms used in our test are presented in Appendix A.

We employ five criteria for the classification of securities into the first 25 portfolios, which are the following:

- Alphabetical order (based on Greek characters)
- Entry date on the Athens Stock Exchange
- Market capitalization (in other words, firm size)
- Price-to-earnings ratio (P/E)
- Market Beta

Our goal here is to obtain the higher as possible degree of diversification to ensure that only common risk sources affect portfolio returns. Alphabetical order and entry date are naive criteria, devoid of any theoretical background. The other three criteria will help us to allocate securities into categories with similar characteristics; high and low capitalization firms, income and growth securities, relatively safe and risky equities. We rank stocks in ascending order (e.g. from these with the highest capitalization to those with the lowest capitalization, from the oldest to the newest etc). We use only these securities listed on the ASE before 1995 with the aim of including equities with well-known risk-return characteristics and to the investors.

In addition we form seven, equally weighted, industrial portfolios. Each one consists of firms with similar characteristics and business activity. For example the 'consumption' portfolio contains firms of the clothing, food and beverages sectors. The average size of these portfolios is approximately 20, with a minimum of 8 and a maximum of 33 securities. The purpose of forming these portfolios is to examine the major differences of risk and return among industries.

In appendix B, we present the composition of the thirty-two portfolios used in our tests. The following table summarizes the total return, standard deviation (risk) and the Sharpe ratio of our portfolios, in order to obtain an idea of their performance during the period July 1997-August 1998.

Table 5.1: Mean return, standard deviation and Sharpe ratio (July 97 –Aug 01)

Portfolios	TOTAL RETURN	STANDARD DEVIATION	SHARPE RATIO
Alphabetical 1	3,40%	14,27%	0,189
Alphabetical 2	4,33%	15,38%	0,236
Alphabetical 3	3,67%	14,33%	0,207
Alphabetical 4	4,77%	15,87%	0,256
Alphabetical 5	5,00%	13,79%	0,311
Capitalization 1	1,40%	11,22%	0,062
Capitalization 2	2,74%	13,88%	0,147
Capitalization 3	5,26%	14,69%	0,310
Capitalization 4	5,89%	17,18%	0,301
Capitalization 5	5,74%	18,48%	0,272
Entry Date 1	1,98%	14,65%	0,087
Entry Date 2	4,31%	14,03%	0,257
Entry Date 3	4,02%	14,16%	0,234
Entry Date 4	4,19%	16,18%	0,215
Entry Date 5	6,59%	14,94%	0,393
Beta 1	4,77%	20,57%	0,197
Beta 2	5,08%	17,23%	0,254
Beta 3	6,62%	15,11%	0,391
Beta 4	3,22%	12,20%	0,206
Beta 5	1,34%	10,19%	0,062
P/E 1	5,36%	16,13%	0,288
P/E 2	2,78%	14,77%	0,140
P/E 3	6,12%	14,49%	0,374
P/E 4	4,43%	13,51%	0,275
P/E 5	2,40%	14,83%	0,114
COMMERCE	6,22%	15,36%	0,359
CONSTRUCTION	7,11%	18,57%	0,345
INDUSTRY	2,82%	13,94%	0,151
NEW TEC	1,45%	14,15%	0,052
TEXTILE	4,81%	19,26%	0,213
CONSUMPTION	7,42%	13,36%	0,502
FINANCIAL	1,51%	12,39%	0,065

Note: Sharpe ratio is estimated from the equation $\frac{Rp - Rf}{\sigma(Rp)}$. Standard deviations σ(Rp) are calculated from monthly returns. Rf is the monthly risk-free return. The mean monthly 3-month T-bill rate was 0,71% during the period July 1997-August 2001.

5.2 ESTIMATION OF PORTFOLIO FACTOR LOADINGS

In this step we start estimating our five-index model by employing the first-pass of the Fama-McBeth approach. We begin our analysis by regressing the monthly returns of 32 well-diversified portfolios, constructed above, against the unexpected monthly changes in the risk factors estimated in the previous section. In other words, we run 32 time series OLS regressions of the following type to estimate the sensitivity of our well-diversified portfolios to the systematic risk factors:

$$r_{pt} = a_{p0} + \beta_{p1} \times f_{1t} + ... + \beta_{p5} \times f_{5t} + \varepsilon_{pt} \quad (1)$$ where,

r_{pt} = the realized return on industry portfolio p in month t, p= 1,2 ,....,32, t= 1,2 ,...50.
a_{p0} = the intercept for the portfolio p
β_{pj} = the factor beta for portfolio p on factor j
f_{jt} = the unexpected change in the economic variable j in month t
ε_{pt} = the residual error for portfolio p in month t

In fact, equation 1 represents our multi-factor model that is assumed to explain stock returns in the Greek stock market. We perform these tests in order to obtain a more reliable picture of the impact of the selected risk factors on stock values. The derived risk exposures of each portfolio to the economic surprises are displayed in table 5.2. Panel A displays the industrial portfolios and panel B the rest of our portfolios. In the first column portfolio names are stated, in columns 2-6 the estimated betas for each risk factor and in column 7 the coefficients of determination. In parentheses we report the t-statistic. Figures in bold letters denotes statistical significance at the 5% level and figures in bold letters, with an asterisk, denotes significance at 10%.

Table 5.2: Factor betas on portfolios

PANEL A

PORTFOLIOS	DEF	INF	RET	RM	TS	R^2
COMMERCE	-0,393	-0,187	**-1,606***	**0,724**	**-0,515***	38,65%
	(-0,983)	(-0,961)	(-1,869)	(4,418)	(-1,858)	
CONSTRUCTION	-0,477	**-0,420***	**-2,390**	**1,011**	-0,366	51,27%
	(-1,104)	(-1,999)	(-2,581)	(5,728)	(-1,230)	
INDUSTRY	0,029	-0,099	**-1,660**	**0,821**	**-0,466**	53,29%
	(0,124)	(-0,642)	(-2,439)	(6,335)	(-2,126)	
NEW TEC	-0,015	0,100	**-2,002**	**0,861**	**-0,649**	61,19%
	(-0,017)	(0,694)	(-3,179)	(7,174)	(-3,194)	
TEXTILE	-0,330	0,017	-1,129	**0,930**	**-0,639***	34,73%
	(-0,630)	(0,062)	(-1,015)	(4,390)	(-1,781)	
CONSUMPTION	-0,004	-0,114	**-1,608**	**0,763**	**-0,469**	51,48%
	(0,015)	(-0,756)	(-2,419)	(6,024)	(-2,188)	
FINANCIAL	-0,044	0,053	**-1,713**	**0,823**	**-0,422**	66,03%
	(-0,148)	(0,442)	(-3,321)	(8,375)	(-2,537)	

Note: t-statistic in parenthesis- Critical value=2. Coefficient in bold letters denotes significance at 5% level. * denotes significance at 10% level.

Panel B

PORTFOLIOS	DEF	INF	RET	RM	TS	R^2
Alphabetical 1	-0,238	-0,087	**-1,453**	**0,869**	**-0,527**	55,62%
	(-0,769)	(-0,566)	(-2,138)	(6,710)	(-2,392)	
Alphabetical 2	-0,362	-0,199	**-1,965**	**0,973**	**-0,456**	61,86%
	(-1,173)	(-1,287)	(-2,895)	(7,522)	(-2,075)	
Alphabetical 3	-0,158	-0,157	**-1,998**	**0,865**	**-0,500**	58,83%
	(-0,529)	(-1,049)	(-3,040)	(6,913)	(-2,350)	
Alphabetical 4	-0,287	-0,108	**-1,925**	**0,839**	**-0,462***	44,56%
	(-0,747)	(-0,562)	(-2,279)	(5,215)	(-1,688)	
Alphabetical 5	-0,216	-0,117	**-1,829**	**0,757**	**-0,485**	49,95%
	(-0,681)	(-0,738)	(-2,622)	(5,697)	(-2,146)	
Capitalization 1	-0,008	0,053	**-1,579**	**0,843**	**-0,314**	80,11%
	(-0,049)	(0,650)	(-4,413)	(1,238)	(-2,712)	
Capitalization 2	-0,120	-0,049	**-1,786**	**0,923**	**-0,442**	65,00%
	(-0,448)	(-0,363)	(-3,044)	(8,255)	(-2,328)	
Capitalization 3	-0,192	-0,132	**-1,790**	**0,790**	**-0,526**	47,53%
	(-0,555)	(-0,764)	(-2,354)	(5,455)	(-2,135)	
Capitalization 4	-0,366	-0,209	**-2,398**	**0,889**	**-0,519***	46,73%
	(-0,898)	(-1,025)	(-2,676)	(5,206)	(-1,789)	
Capitalization 5	-0,576	-0,332	-1,616	**0,858**	**-0,629***	38,91%
	(-1,227)	(-1,412)	(-1,565)	(4,365)	(-1,881)	
Entry Date 1	-0,192	-0,087	**-1,621**	**0,883**	**-0,504**	54,61%
	(-0,600)	(-0,543)	(-2,298)	(6,570)	(-2,203)	
Entry Date 2	-0,254	-0,047	**-1,789**	**0,759**	**-0,586**	49,62%
	(-0,784)	(-0,290)	(-2,513)	(5,600)	(-2,540)	
Entry Date 3	-0,197	-0,102	**-1,543**	**0,847**	**-0,450**	53,39%

	(-0,628)	(-0,651)	(-2,232)	(6,435)	(-2,009)	
Entry Date 4	-0,300	-0,191	**-2,294**	**0,960**	**-0,470***	56,81%
	(-0,867)	(-1,102)	(-3,018)	(6,631)	(-1,909)	
Entry Date 5	-0,318	-0,241	**-1,922**	**0,853**	**-0,421***	53,40%
	(-0,959)	(-1,454)	(-2,637)	(6,145)	(-1,784)	
Beta 1	-0,766	-0,330	**-2,766**	**1,013**	**-0,588***	45,54%
	(-1,551)	(-1,336)	(-2,549)	(4,902)	(-1,673)	
Beta 2	-0,535	-0,247	**-1,815***	**0,893**	**-0,563***	45,36%
	(-1,291)	(-1,195)	(-1,993)	(5,149)	(-1,910)	
Beta 3	-0,083	-0,102	**-1,682**	**0,821**	**-0,551**	46,79%
	(-0,231)	(-0,571)	(-2,135)	(5,470)	(-2,158)	
Beta 4	0,006	0,040	**-1,772**	**0,859**	**-0,434**	73,78%
	(0,031)	(0,393)	(-3,966)	(10,092)	(-3,000)	
Beta 5	0,114	-0,029	**-1,136**	**0,717**	**-0,294**	69,45%
	(0,624)	(-0,313)	(-2,821)	(9,352)	(-2,255)	
P/E 1	-0,395	-0,191	**-2,002**	**0,828**	**-0,580**	46,03%
	(-1,026)	(-0,991)	(-2,364)	(5,134)	(-2,114)	
P/E 2	-0,233	-0,141	**-2,043**	**0,897**	**-0,447**	58,04%
	(-0,747)	(-0,908)	(-2,988)	(6,889)	(-2,018)	
P/E 3	-0,334	-0,162	**-1,591**	**0,869**	**-0,433***	54,67%
	(-1,054)	(-1,021)	(-2,282)	(6,541)	(-1,919)	
P/E 4	-0,039	-0,092	**-1,768**	**0,870**	**-0,397**	61,70%
	(-0,142)	(-0,674)	(-2,958)	(7,639)	(-2,051)	
P/E 5	-0,261	-0,082	**-1,765**	**0,839**	**-0,573**	51,48%
	(-0,777)	(-0,491)	(-2,392)	(5,969)	(-2,396)	

Note: t-statistic in parenthesis- Critical value=2. Coefficient in bold denotes significance at 5% level. * denotes significance at 10% level.

The results from the time-series regressions are very encouraging. The majority of the estimated parameters are statistically different from zero (see table 5.3). To be more specific, almost 60% (94/160) of the estimated coefficients are statistically significant at the 5% level. Especially three factors, retail sales, market portfolio and term structure, mostly appear to affect portfolio returns. On the other hand default risk and inflation are not found to have an obvious influence on stock returns. Only one coefficient for inflation rate is different from zero (for constructions) and none for default risk.

Table 5.3: Properties of factor loadings for the 32 portfo1ios

Risk Factor	Significant	Insignificant	Positive	Negative
Default risk	0	35	6	29
Inflation rate	1	34	8	27
Retail sales	33	2	0	35
Market portfolio	35	0	35	0
Term structure	34	1	0	35

Another interesting finding is the high explanatory power of our economic variables on the portfolios' returns. In many cases the coefficients of determination overcomes 60% and on average, fifty percent of portfolio volatility is explained by the risk factors. The higher R-squared is 80,11% for high capitalization stocks and the smaller is 34,73% for textiles. The former result is expected, since large firms play significant role in the course of the Composite Index, employed in this study as a proxy for the market portfolio. Also, it is logical to expect that stock returns be influenced by economic development and changes in interest rates.

Finally, we can deduce from table 5.3 that only market itself affects positively the returns of our portfolios, while the four macrovariables seem to have an adverse impact on returns. This confusing finding can be attributed to the irrational behavior of the Greek stock market during our test period.

Generally speaking, the aforementioned inferences imply that stock returns are actually affected by surprises in economic factors and that we might have chosen the correct set of economic factors, with the exception of default risk and inflation risk. Recall that default risk is estimated in a quite different way from the one proposed by Burmeister et al. Surely, this picture will not remain the same for the individual securities. The sensitivities of individual securities to risk factors and their t-statistics are displayed in Appendix C. At this point we will summarize some descriptive figures of the factor betas of the individual firms.

Table 5.4 reports the number of statistically significant betas for each risk factor and the proportion of positive-negative loadings. Remember that we have 160 securities in our sample and therefore 800 estimates of risk exposures in total. Our findings will be very helpful in the construction of portfolios in the next section of this study.

Table 5.4: Properties of factor loadings for the 160 individual securities

Risk Factor	Significant	Insignificant	Positive	Negative
Default risk	12	148	67	93
Inflation rate	23	137	55	105
Retail sales	82	78	6	154
Market portfolio	153	7	160	0
Term structure	52	108	10	150

The first interesting point is that individual securities exhibit weak sensitivity to default risk and inflation risk and greater exposure to retail sales, time premia and market portfolio. Market portfolio is expected to be a good explanatory variable of the time-series variation of stock returns. Also, it is logical to assume that business activity and interest rates will affect stock returns. In total, approximately 40% of the beta estimates are statistically different from zero. A further revealing finding is the proportion of positive to negative exposures. Stock returns are positively affected by the market index and negatively by retail sales and term structure. Also, stock prices seem to be negatively affected by default risk and inflation, but here the picture is not so clear.

These results are owed to the fact that stock prices have declined rapidly in the greater part of the test period, while retail sales and the difference between long-term and short-term returns have followed the opposite direction. As we can see from table 5.4, the situation is more balanced as it is concerned default risk and inflation rate. The sign of factor loadings will influence our investment strategy described in the last section, since it is irrational to accept that a favorable change in business activity will negatively affect stock returns.

It is worthwhile to examine the number of significant factor loadings for each security and the proportion of significant market betas in the total sample of stocks with only one significant factor. Table 5.5 depicts these results. Panel A presents the number of significant risk exposures in relation to sample of firms and panel B displays the number of firms, for which market risk is the only pervasive factor, when we take into account only firms affected by one risk factor.

Table 5.5: Significant factors and number of firms

Panel A: Significant betas and Firms

Number of statistically significant betas	0	1	2	3	4
Number of firms	2	48	63	40	7

Panel B: Market Factor as the only significant risk factor

Risk Factor	Market risk	Other risk factor
Number of firms affected by one factor	44	4

As we can see from this table, sixty-three securities are exposed to two factors, forty-eight to one factor and forty firms to three factors. It is very encouraging that only two securities are unaffected by economic variables. These findings prove that we have estimated our factors in a quite satisfactory way and also that three or even four is the suitable number of risk factors that affect stock returns. Keep in mind that default risk, the poorer explanatory macrovariable, has been determined in a quite different manner in comparison with previous studies.

In addition, market factor prevails over the four macrovariables, when only one factor is found to influence stock returns. This is verified for almost 92% of these cases and this is evidence that market index is the most significant explanatory variable of stock variation.

5.3 ECONOMIC INTERPRETATION OF FACTOR LOADINGS

It is very interesting to examine whether stock sensitivities to risk factors have the sign that theory would lead us to expect and if they are statistically significant. In order to implement this analysis we construct nine, equally weighted, sector portfolios. The criterion for the distribution of firms in the first seven portfolios is the nature of their activity. These portfolios consist of stocks that belong in the same sector or in relative industries and exhibit common operational characteristics and growth opportunities. The purpose of this classification is to develop pseudo-industries and see how macrovariables affect their returns. The labels of the seven groups are: commerce, construction, industrial, technology, textiles, consumption and financial.

The first group includes firms of the retail and wholesale trade. Their basic features are the dependence of their earnings on business activity and inflation and their small market capitalisation. For that, we can regard them as cyclical stocks.

Firms that belong to the Construction sector have been positively affected by the stable growth of the Greek economy during the last five years and the rise of public investments in projects of infrastructure. The market size of these firms differs significantly within this sector and their future prospects remain robust.

Textile is one of the most traditional industries of the Greek economy. Textile firms are highly leveraged and for this reason, the gradual fall of interest rates has improved their operational ratios and enhanced their earnings. Their market capitalisation is rather small and their stock prices have been very volatile after 1998. The performance and the future prospects of this industry are closely connected with the state of the domestic economy.

The technological group consists of firms that operate in information technology and telecommunications. They are highly leveraged and very sensitive to changes in interest rates. Their stock prices boomed in the last years, but the recent recession of the US economy has an adverse impact on their returns. In general, it is safe to characterise them as growth stocks.

The industrial portfolio includes the main companies of the Greek industry. These firms are very sensitive to the business cycle and term structure. In general, they have achieved stable growth rates and can be regarded as income stocks.

In the financial portfolio we include shares of the banking and the insurance sector. They are known to be income stocks, have large market capitalisation and affect significantly the Composite Index. Their profits are mainly affected by changes in the interest rates and the economic cycle.

Finally the consumption group consists of firms that produces consumer goods like food and beverages. The majority of these firms have medium market capitalisation and their profits are not so sensitive to inflation risk. Also, firms that sell 'necessities' are relatively insensitive to declines in real income.

The selection of stocks in the last two portfolios is based on their market capitalisation. Each portfolio includes 25 stocks, those with the largest and the smallest size in our sample. We decide to form these portfolios in order to examine how the sensitivities of stocks to each risk factor vary according to their size. The last two portfolios are labelled as "blue chips" and "small cap". An alternative label could be income stocks and growth stocks respectively.

In order to estimate the sensitivities (betas) of each portfolio, we estimate their monthly returns from July 1997 to August 2001. Then we regress their monthly returns against the risk factors and an intercept. The results are presented in table 5.5 and have an intuitive appeal.

Table 5.5: Sector sensitivities

SECTOR NAME	DEFAULT	INFLATION	BUSINESS CYCLE	RESIDUAL MARKET	TERM STRUCTURE	R^2
COMMERCE	-0,393	-0,187	**-1,606**	**0,724**	**-0,515**	0,39
CONSTRUCTION	-0,477	**-0,420**	**-2,390**	**1,011**	-0,366	0,51
INDUSTRIAL	0,029	-0,099	**-1,660**	**0,821**	**-0,466**	0,53
TECHNOLOGY	-0,015	0,100	**-2,002**	**0,861**	**-0,649**	0,61
TEXTILES	-0,330	0,017	-1,129	**0,930**	**-0,639**	0,35
CONSUMPTION	-0,004	-0,114	**-1,608**	**0,763**	**-0,469**	0,51
FINANCIAL	-0,044	0,053	**-1,713**	**0,823**	**-0,422**	0,66
BLUE CHIPS	0,024	0,065	**-1,492**	**0,851**	**-0,320**	0.81
SMALL CAP	-0,576	-0,332	-1,616	**0,858**	**-0,629**	0,39

* The coefficients in bold are statistically different from zero at 10% level.

The first discernible finding of this empirical analysis is that securities in the Greek stock market seem to be quite insensitive to default risk and inflation risk. Only the construction sector has an exposure to inflation risk which is statistical different from zero. As we have expected a priori, residual market affects portfolio returns. We draw the same conclusion and for the term structure, with the exception of the construction sector. Business cycle influences returns in seven of our nine portfolios. Textiles and small capitalisation firms are found to be insensitive to the unexpected changes in real income. In general, three economic variables for each portfolio at least, are statistically significant and should be regarded as sources of non-diversifiable risk by investors.

Another interesting point here is that our five risk factors accounts in average for about 50% of the variability in portfolio's returns. As we can see, the coefficient of determination is very high (81%) for the "blue chips" and the financial sector (66%). The lowest explanatory power of our factor is appeared for the textiles (35%), trade companies (39%) and small cap group (39%)

Furthermore, extensive attention should be paid to the sign of each coefficient for extracting useful inferences about the validity of our model. The first thing to focus on is that two risk factors and more specifically term structure and economic growth carries negative signs. This means that an unexpected positive change in one of these variables should affect negatively stock returns. On the other hand, the picture is not so clear for default risk and inflation risk. Returns on some portfolios are positively related to these factors, but this is not the case for others. Finally, residual market has a favourable impact on stock returns.

To begin with the risk factor labelled as residual market, a positive and robust relation to stock returns is anticipated to exist. We should mention at this point, that the residual market is computed as the part of the ASE-60 total return that is not explained by the first four macroeconomic risks. It is almost certain that all stocks have a positive exposure to this risk factor. The meaning of the positive sign is that stock returns change in the same direction with the whole stock market. Stock market's variation mostly influences textiles and construction, while the commercial and the consumption sectors are less sensitive to it.

Stock returns seem to be adversely affected by the growth rate of the economy and this is a quite confusing finding. The intuition behind this is that stock prices will rise when economy expands rapidly. A possible explanation for that is the irrational behaviour of the Greek stock market in the last four years. To be more specific, stock prices declined sharply after September 1999, while in the same time GDP grew at a stable pace. The most sensitive securities to this risk factor are those of the technological and the construction sector. This finding is anticipated since the profits of the above sectors are quite dependent on business cycle. In general, all sectors are greatly influenced by economic activity except from textiles and small firms.

Changes in the term structure have a substantial impact on returns, as it appears in table 5.5. Only the construction sector has a statistical insignificant exposure to this factor. Time-horizon risk measures the willingness of investors to invest in the long run. An increase in its value implies that investors require a lower compensation for holding assets with longer maturity. A positive realisation of time-premia should lead to a rise in stock prices, and for that, stock returns should be positively affected by this factor.

But in our case, term-structure seems to have an adverse impact on stock prices. A possible explanation for this finding is the short-term investment horizon of the Greek investors. It is sensible to expect that growth stocks will be affected more than income stocks by this factor. Indeed, firms with small market value and securities from the technological sector, which are characterised by investors as growth stocks, are strongly affected by unexpected changes in the term structure. On the other hand, firms with large capitalisation, known as blue chips, are the least sensitive to this risk factor.

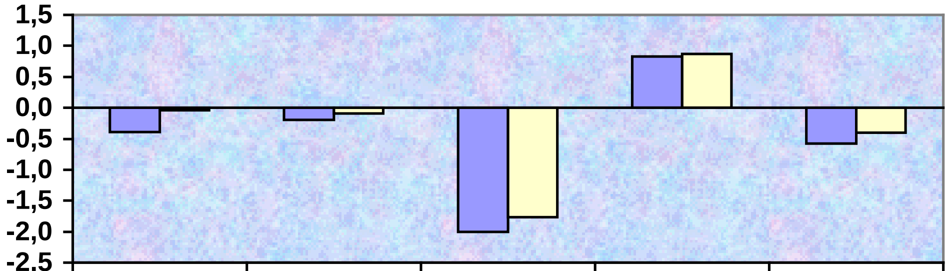
The picture is not so clear for inflation. Five sectors have negative exposure to inflation risk and from them, only for the construction sector this variable is statistically significant. On the other hand, four industries are favourably influenced by shocks in this macrovariable.

We must note here that there has been a period of constant deflation in the Greek market. Economic theory suggests that most equities have negative betas to inflation risk. So, a deflation shock should contribute positively to their returns because real income rises. The other four sectors show a conflicting picture since they seem to be favourably affected by inflation risk. As we can see their betas are very small and this fact allows us to conclude that these sectors are unaffected by shocks in inflation.

Default risk is not a pervasive factor for the entire sample. Probably, this finding is owed to the adopted measurement method. To be more specific, we determine risk premium as the difference between lending and deposit rates, since there is a lack of corporate bonds in Greece. A fall in the value of this risk factor reflects increased investor confidence and indicates that market demands small risk premium. As a consequence, stock returns should rise and factor betas be negative. In general, small stocks tend to be more sensitive than large stocks to default risk. As we can see, our findings verify this assumption. Small firms present greater sensitivity to default risk than blue chips or industries. The high leverage of small stocks makes them more vulnerable to changes in risk premia. On the contrary, income stocks are weakly affected by this factor and this is obvious if we compare their risk exposure with those of growth stocks. In fact, coefficients' values are so petty that we can say that the returns of Greek large stocks are unrelated to default risk.

In the next figure, we compare the risk exposure profiles of two portfolios. The first consists of the twenty-five stocks with the lowest price-to earnings ratio (P/E) in our sample. The second group includes the stocks with the highest P/E ratio. The purpose of this comparison is to discover whether or not the portfolio's sensitivities vary along with P/E. Usually investors think that firms with high P/E have good growth opportunities and relatively higher future earnings. In contrast, companies with lower P/E are regarded as stable stocks, whose future earnings would change with modest rates. Of course, we should be very careful since a high P/E ratio may be caused by low profits and poor future prospects.

Figure 5.1: The risk exposure profile for a portfolio of the twenty-five lowest and highest P/E stocks



	Default	Inflation	Business Cycle	Residual Market	Term Structure
High P/E	-0,395	-0,191	-2,002	0,828	-0,580
Low P/E	-0,039	-0,092	-1,768	0,870	-0,397

As it is evident from figure 5.1, the portfolio with high price-to earnings ratio is more sensitive to the macroeconomic variables. This is an expected result, since the performance of these firms is greatly dependent on macroeconomic factors such as interest rates, inflation rates and economic activity. In contrast, firms with low P/E do not respond to an increased level of business activity because they have attained stable growth rates.

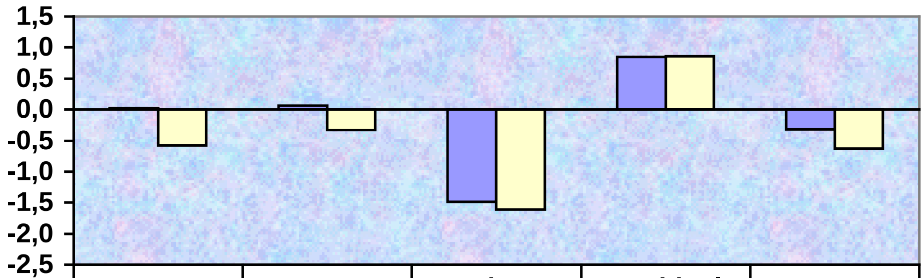
To our surprise, the portfolio with the low price-to earnings ratio has greater exposure to the market risk. This finding is not so sensible, since the firms with low P/E are those labelled as income stocks, whose prices are not so volatile.

Another interesting point is that the portfolio risk exposures to default risk have opposite signs. It is sensible to expect that stock returns will be favourably affected by changes in investors' willingness to undertake riskier investments. It seems here that a small premium will influence prices of growth stocks more than those of income stocks.

Furthermore, the sensitivities of these portfolios to the term structure differ greatly. It is logical to expect that investors would prefer to allocate their funds in favour of small firms, which are more likely to expand faster in future, when risk premia fall. Finally, stocks with high P/E seem to be more sensitive to business cycle risk than stocks with low P/E ratio. It is natural to believe that a favourable economic environment will ensure the prospective operating and investment performance of growth stocks.

Figure 5.2 compares the risk exposure profiles for portfolios of low-capitalisation versus high capitalisation stocks. These portfolios consist of twenty-five stocks with the lowest and the highest market value in our sample. We label these portfolios as small capitalisation and blue chips respectively

Figure 5.2: The risk exposure profile for a portfolio of the twenty-five largest and smallest stocks in market capitalization



	Default	Inflation	Business Cycle	Residual Market	Term Structure
Blue chips	0,024	0,065	-1,492	0,851	-0,320
Small cap	-0,576	-0,332	-1,616	0,858	-0,629

As we can see from figure 5.2, small capitalisation stocks are more sensitive to all risk factors. Business cycle, term structure and residual market mostly influence returns of both portfolios. We notice also that default risk and inflation risk don't affect so much the returns on blue chips. On the other hand, small firms appear to be more sensitive to changes in these factors as they are more risky assets and their future earnings are heavily dependent on inflation.

Business cycle strongly affects both high and low capitalisation stocks in a negative way. As usual, market has a great impact on the returns of all stocks, regardless of their market value. Finally, small stocks are twice as sensitive as large stocks to changes in confidence risk (as it is estimated from changes in the term structure). Usually, shares of large firms are characterised as income stocks. These equities are safer but they don't offer high capital gains. On the contrary, when individuals are willing to hold long-term investments, small stocks benefit more because they promise considerable yields in the long run.

SECTION 6

ACTIVE AND PASSIVE PORTFOLIO MANAGEMENT

6.1 INTRODUCTION

In this section of our analysis we use the multi-index model, estimated in the previous section of this paper, in portfolio management. We focus on passive and active investment strategies and construct portfolios with predetermined risk profiles. The purpose of our tests is to verify whether we can obtain desirable results by employing our multi-index model in portfolio management. We examine the main two forms of portfolio management: active and passive. Recall that active portfolio management is concerned with making controlled factor bets in order to take advantage of favorable changes in risk factors. On the other hand, passive management is involved with the formation of portfolios that closely track an index and implicitly carry the same amount of risk in comparison with it.

By constructing portfolios, we aim at outperforming the market itself. But the final outcome of our investment strategies should not lead us to the acceptance or the rejection of our model. It is very important to examine the portfolio's performance in relation to the level of risk that our investment is subject to. For this reason we calculate the risk-adjusted returns of our portfolios to evaluate their performance in comparison to the target stock indices. The greater the risk-adjusted returns are (in algebraic values), the better the portfolios' performance is and so the ris-return tradeoff will assess the empirical applicability of our multi-index model.

We perform our investment analysis for the period September-November 2001 in passive management and for two distinct months (October and November 2001) in active management. For the implementation of active management we obtain ex-post forecasts of the surprises in our macroeconomic risk factors from our VAR model.

At this point it is useful to give a short description of the state of the Greek economy and stock market during this period. To begin with the stock market, the terrorist attacks on the US in September 11th caused a sharp decline in stock prices worldwide. The Athens Stock Exchange was no exception and in September, the Composite Index ASE-60 suffered a 21,5% decline. Lower stock prices encouraged market participants to invest in the stock market and the market absorbed some of the negative impact of the terrorist strike. As a result, stock prices recovered quickly and rose by 10,33% in October and 8,75% in November and the Composite Index reached the level of 2700 points, in the last days of November, 6.0 per cent higher than on September 10th. In total, the ASE-60 dropped by 2,5 per cent, during the period September-November 2001. From the 160 securities included in our sample, seventy-one achieved positive returns, four remained stable and eight-five had negative returns. The influence of the specific political event on the stock market worldwide and on the psychology of market participants is not welcome in our study because it is likely to distort the impact of economic surprises on stock prices and the efficiency of our model.

During the sample period, the Greek economy continued to grow at stable rates while inflation declined from 3,6 percent in September, to 2,4 percent in November. Deflation led to the fall of long- and short-term of bond yields but the latter was greater, implying fears of future inflationary pressures. Finally the spread between lending and deposit rates, which is regarded as the measure of default risk in our study, has increased slightly from August. In general, the economic state has retained its favorable future prospects.

We have referred above to the risk-adjusted returns and consider them to be the determinants of the success of our investment choices and therefore of our multifactor model. The estimation of this measure is based on the Sharpe's ratio. As it has been noted in previous section, this index is given by the equation $SR = \frac{R_P - R_F}{\sigma(R_p)}$, where Rp is the overall portfolio's return, Rf is the risk- free rate of return and σ(Rp) the standard deviation of returns. But if our portfolios have negative total returns, then the Sharpe's ratio becomes meaningless. Because the Greek stock market has dropped during the test period of passive portfolio management, negative excess return has no meaning. Alternatively, we have decided to estimate portfolio risk-adjusted return as the ratio of the total portfolio return to the total risk, measured by the standard deviation of returns [RAR = Rp/σ(Rp)]. The portfolio that exhibits the lower algebraic value of RAR, will be regarded as being the best and we judge the performance of our strategies in terms of risk- adjusted returns.

At this point we discuss some technical issues of the implementation of portfolio management. As it is noted above, the specification of the portfolio's betas requires the estimation of the betas of individual securities. But we have seen in section 3 that a substantially number of stock exposures is not statistically significant, which in the parlance of statistics means that they are not different from zero. For the convenience of our tests, we will treat the betas of every firm as being statistically important and use them in portfolio formation.

Another subtle point is the fact that almost every security in our sample exhibits negative exposure to business cycle risk, as it is measured from unanticipated changes in real retail sales. This finding is owed to the adverse course of stock market in relation to the economic activity (GDP increased at a robust pace while ASE-60 fell rapidly after September 1999). It seems unreasonable to accept that a propitious surprise in business activity will have an adverse impact on stock prices (we are not talking about expected returns). However, we decide to take into account this confusing property in the implementation of our investment strategies and check its role in real world.

Finally, it is very illuminating to describe in short the computation method of the stock selection and weights attached to each security. What we face here is a problem of linear programming, easily solved with the help of a software package. We seek for a combination of equities, weighted in a way that can produce the same risk exposure profile with that of the target index. The basic restriction here is that the sum of weights does not exceed unity and their values are positive or at least equal to zero. To achieve greater diversification, we set the additional restriction that stock weights are not greater than 10% (in case of course we can find a plausible solution). In passive management we constrain our portfolio's betas to match to those of the benchmark index, while in active management we make a factor bet by requiring the minimization or the maximization of the exposure to the specific factor according to its forecasted unexpected change.

6.2. PASSIVE PORTFOLIO MANAGEMENT

The basic idea of passive portfolio management is the construction of portfolios with similar risk characteristics and therefore the same expected returns to a benchmark index. This goal is achieved by matching the portfolio risk exposure to all risk factors with that of the selected target stock index. Here, we do not need factor forecasts since risk is regarded as a threat and not as an opportunity.

Passive management is considered to be a defensive strategy since we accept that a stock index is a well-diversified portfolio and it is very difficult to obtain a superior performance from it. Defensive strategies intend to shield a portfolio's return from undesired factor influences and their main goal is "risk sterilization". The most secure way to achieve this objective is by "buying" an index or track an index by forming a portfolio, which exhibits the same risk characteristics but includes a smaller number of securities.

In our analysis we choose five stock indices as the benchmark portfolios, which are the following:

- The Composite ASE-60 Index, which has been used as the proxy for the market portfolio in previous steps of our analysis.
- The FTSE-20 Index, which consists of securities with the largest market capitalization and therefore most actively traded during the last years.
- The Banking Index, which includes firms that affect substantially the overall market performance.
- The Industrial Index, which is a traditional sector of the Greek economy and plays crucial role in the overall course of the security market.

- The Construction Index, which contains some of the most important Greek firms, and is expected to flourish in the future due to the increased public investments in infrastructure and the Olympic Games of 2004.

The first task in the implementation of passive portfolio management is the computation of the sensitivities of the chosen target indices, one for each of the five selected risk factors and for the time period July 1997-August 2002. This is accomplished in the same way we have estimated the betas of individual stocks. As we have mentioned above, we do not take into account the statistical significance of the estimated coefficients, but we employ the factor loadings as they are computed by the OLS regression described above. Table 6.1 displays the estimated betas for each of the six-selected target indices, the t-statistic and the R-squared measure, in order to obtain a complete view of the explanatory power of our risk factors on the target indices' returns.

Table 6.1: Factor betas on benchmark portfolios

BENCHMARK PORTFOLIOS	DEF	INF	RET	RM	TS	R^2
ASE-60 INDEX	**-0,155**	**0,080**	**-1,303**	**1,003**	**-0,150**	99,99%
	(-23,306)	(24,112)	(-89,228)	(360,707)	(-31,699)	
FTSE-20 INDEX	-0,203	**0,192**	**-1,382**	**0,935**	-0,150	85,92%
	(-1,356)	(2,503)	(-4,190)	(14,441)	(-1,374)	
BANKING INDEX	-0,309	**0,205**	**-1,386**	**1,062**	-0,149	81,63%
	(-1,629)	(2,157)	(-3,320)	(13,357)	(-1,101)	
INDUSTRIAL INDEX	0,077	0,081	**-1,262**	**0,850**	**-0,260**	83,89%
	(0,546)	(1,155)	(-4,075)	(14,397)	(-2,592)	
CONSTRUCTION INDEX	-0,315	**-0,383**	**-1,711**	**1,145**	-0,335	60,70%
	(-0,865)	(-2,106)	(-2,138)	(7,510)	(-1,292)	

Note: t-statistic in parenthesis- Critical value=2. Coefficient in bold denotes significance at 5% level. * denotes significance at 10% level.

The first important point here is the great explanatory power of factor loadings on portfolio returns. This finding heavily depends on the influence of market timing risk, which is based on the market itself and is known to be a good explanatory variable of stock volatility. For this reason the coefficient of determination is almost 100%. The lowest R-squared is that of the construction index, while it exceeds 80% for the rest stock indices.

Furthermore, almost seventy per cent of the estimated betas are statistically significant and this fact is very encouraging for the credibility of our multi-index model. Default risk is the least important factor, probably because of the way of its determination, and only the industrial sector is positively affected by it. Inflation risk is statistically important for almost every stock index, with the exception of industries, while business cycle risk has a strong impact on our stock indices. Market portfolio is a substantial explanatory factor, as it is expected to be, whereas surprises in the term structure are not appeared as a pervasive risk factor of stock returns.

A very impressive issue is the similar risk exposure profile of the ASE-60 Index and the FTSE-20 Index. But if we recall that FTSE-20 index is a subset of ASE-60 index then this similarity is easily explained. In general, we can say that the ASE-60 is less affected by economic factors because it consists of much more securities than the other indices under consideration and thus achieves more extensive diversification. On the other hand, the construction index is more sensitive to all risk factors and therefore an investment in this sector entails more risk and higher yields.

The next step in our analysis is the determination of stock weights in our portfolios, in a way that ensures the matching of their risk sensitivities to those of the target indices. This is a problem of multiple goal programming and its representation is presented above.

1) $\sum_{i=1}^{160} w_i = 1$

2) $w_i \geq 0$

3) $w_1 \times b_{1,j} + w_2 \times b_{2,j} + ... + w_{160} \times b_{160,j} = b_{p,j} = b_{t,j}$

4) $w_i \leq 0{,}10$ (optional)

5) $\min[\sigma^2(e_i)] = \min[\sum w_i^2 \sigma^2(e_i)]$

where,

w = weights

i = number of securities, $i = 1,2,3,.... ..,160$

j = risk factors, $j = 1,2,...,5$

b_{1j} = exposure (beta) of security 1 on factor j

b_{pj} = exposure (beta) of portfolio p, on factor j

b_{tj} = exposure (beta) of target index t, on factor j

$\sigma^2(e_i)$ = *residual risk*

The first constraint is that the sum of weights should equal unity and the second that each individual stock weights should be positive or equal to zero. The third restriction, imposed on every risk factor, shows that the sensitivity of portfolio p to factor j is equal of the sum of the product of stock sensitivities times their weights and this is set to be equal to the sensitivity of the target index to this factor. The fourth restriction is optional and is being imposed in order to achieve greater diversification. Finally, the last restriction requires the minimization of nonsystematic portfolio risk. In fact, this property motivates us to define well-diversified groups of shares. Under these restrictions we proceed with the specification of the weights attached to each security in our sample and the formation of portfolios with the same risk attributes to those of the benchmark portfolios.

The last step in the analysis of passive investment strategies is the evaluation of portfolio performance. In order to obtain a complete view of the performance of the index portfolios in relation to the target index we must jointly examine the tradeoff between risk and return. The ratio of total return to total risk measures the risk-adjusted returns of the portfolios under consideration and enhances the assessment of the adopted passive strategies.

Table 6.2 presents the basic characteristics of the index portfolios, constructed according to the aforementioned restrictions, and of the benchmark portfolios. To be more specific, this table displays the total returns, average returns and standard deviation of returns. The first two characteristics are a crude measure of the portfolio performance during the investment horizon while deviation of returns from the mean indicates portfolio risk. The composition of the generated portfolios used in passive portfolio management is presented in appendix D.

Table 6.2: Characteristics of Passive Portfolios and Benchmark Stock Indices

Panel A

Portfolios	**Total Return**	**Portfolio Mean Return**	**Standard Deviation of Returns**
Portfolio 1 (tracking ASE-60 Index)	-1,89%	-0,03%	0,028
Portfolio 2 (tracking FTSE-20 Index)	-1,75%	-0,03%	0,028
Portfolio 3 (tracking Banking Index)	-5,50%	-0,08%	0,029
Portfolio 4 (tracking Industrial Index)	+0,02%	0%	0,026
Portfolio 5 (tracking Construction Index)	-0,89%	-0,01%	0,036

Panel B

Benchmark Portfolios	**Total Return**	**Portfolio Mean Return**	**Standard Deviation of Returns**
ASE-60 Index	-2,50%	-0,04%	0,020
FTSE-20 Index	-5,13%	-0,08%	0,020
Banking Index	-8,20%	-0,13%	0,023
Industrial Index	-1,32%	-0,02%	0,021
Construction Index	-1,17%	-0,02%	0,029

Note: Mean returns and standard deviations are computed on daily basis.

It is apparent that our portfolios are subjected to a greater degree of risk in comparison to the target indices. This is not a welcome finding because we have constructed them to match their risk exposure profile to that of the benchmark portfolios. So, it seems that we have failed to achieve this fundamental goal. But we should take into account that we have assessed portfolio risk as the variability of the rates of return. This measure takes into account not only the systematic risk but also the diversifiable risk resulting from firm-specific forces. For that, it is quite possible that the difference in the degree of risk between our passive portfolios and the benchmark indices is owed to unique risk.

Recall that the selected stock indices (with the exception of Construction Index) consists of large capitalization stocks, known as blue chips, which historically exhibits lower variability. It is obvious also that their risk patterns are almost identical (around 0,02). On the other hand, we have formed our portfolios by using many small capitalization stocks, subject to a greater amount of risk. Possibly this is the reason that explains the higher variability of our portfolios' returns.

Now we focus our attention on the overall portfolio returns. Table 6.3 displays the total return on each passive portfolio and target index, the number of securities included in each of them and the final outcome. It is evident from this table that, the passive portfolios, in contrast to their performance in terms of risk, dominate the benchmark indices in the aspect of total returns. This is not a surprising finding since more risky assets must yield higher returns to investors and this is the case here with our passive strategies. Even though we fail to emulate the variability of benchmark stock indices, we achieve to outperform them in terms of total return. In fact, we succeed in suffering lower losses in relation to stock indices.

Table 6.3: Total returns of the passive portfolios and the benchmark indices

Benchmark **Portfolios**	**Total returns of the benchmark portfolios**	**Total returns of the passive portfolios**	**Final Outcome**
ASE-60 Index	-2,50%	-1,89%	WIN
Number of Securities	56	33	

FTSE-20	-5,13%	-1,75%	WIN
Number of Securities	20	28	
Banking Index	-8,20%	-5,50%	WIN
Number of Securities	16	14	
Industrial Index	-1,32%	+0,02%	WIN
Number of Securities	47	78	
Construction Index	-1,17%	-0,89%	WIN
Number of Securities	36	43	

As we can see from table 6.3, we manage to outperform the target stock indices in all five cases. We should note that the portfolio, which is tracking the Industrial index, has yielded a slightly positive overall return while the market index has fallen by 2,50%. Moreover, we have achieved to overrun the FTSE-20 by 3,38% and the banking index by 2,7%. So, the higher portfolio returns, in relation to the target index, compensate for bearing higher levels of risk

Another interesting point here is the number of shares included in each portfolio. With the exception of the portfolio that tracks the Construction index, the number of stocks used in the group formation is very close to that of the benchmark indices.

Table 6.4 shows the computed risk-adjusted returns of the passive portfolios and the target stock indices. As we have discussed above, we should focus on the tradeoff between return and risk in the evaluation of portfolio performance. Keep in mind that these ratios are going to have negative values, because of the negative total portfolio returns in all cases. For that, we consider those portfolios with the lower algebraic values to achieve superior performance.

The results are very encouraging for the applicability of our multi-index model in passive portfolio management. To be more specific, risk-adjusted returns of our portfolios exceed those of the target indices in all cases. The greatest spread is between FTSE-20 Index and the respective reference portfolio and the smallest is in Constructions. We have managed to outperform the ASE-60 index by more than 0,70% and the top performer portfolio is the one tracking the industrial index. Generally speaking, these results prove that our multi-factor model, estimated for the Greek stock market, can effectively be used in passive portfolio management.

Table 6.4: Risk-adjusted return of the passive portfolios and the target indices

Benchmark **Portfolios**	**Risk-adjusted return of the passive portfolios**	Risk-adjusted return of the benchmark portfolios	**Final outcome**
ASE-60 Index	-0,675	-1,25	WIN
FTSE-20 Index	-0,625	-2,565	WIN
Banking Index	-1,897	-3,565	WIN
Industrial Index	+0,008	-0,628	WIN
Construction Index	-0,247	-0,403	WIN

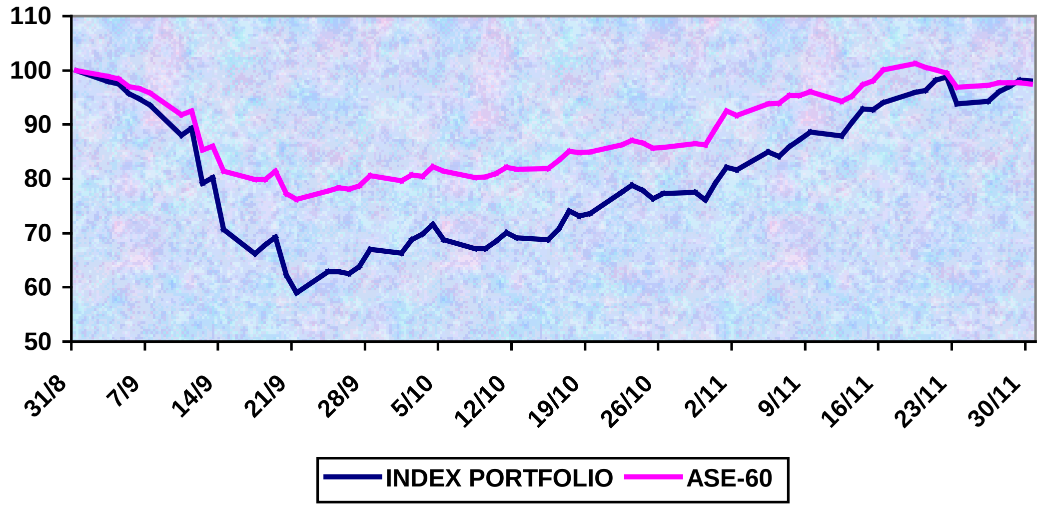
Note: Risk-adjusted return is given by the equation $RAR=(Rp)/\sigma(Rp)$, where Rp is the overall portfolio return and $\sigma(Rp)$ the standard deviation of returns, computed on daily basis.

We complete the description of passive portfolio management by displaying the time plots of our passive portfolios in comparison with that of the respective target indices. In order to make these plots more comparable, we express daily returns as an index, starting from 100. As the basis of this index, we employ the last day before the beginning of our investment period, which is August 31st. For example, a decrease in the daily returns of the considered portfolios by 1 per cent is equivalent to a decrease of 1 unit in our index.

As it is evident from the following figures, the generated portfolios have managed to closely track the target stock indices and this inference reveals the applicability of our estimated multi-index model in passive portfolio management. The terrorist attacks on the US have caused the sharp decline of stock prices. But after September 21st, both our portfolios and target indices recovered and, after an outstanding rally, they have almost regained their initial levels. By looking at these figures we conclude that our portfolios exhibit greater volatility compared to that of the benchmark indices; their value fell more rapidly after the tragedy but their upward movement was greater in relation to the target indices. For this reason, we spot a large gap between the time plots of the two considered indices in September, and the shortening of this spread during the next two months.

In addition, our portfolios that were formed to track the banking and the industrial index seem to be the most successful ones, since their time plot is almost identical with that of the benchmark index. In the other three cases, our portfolios do not achieve to closely imitate the behavior of the corresponding indices in the first two months of the sample period, but they succeed in outperforming them, due to their superior performance in the last fortnight of November. On the balance, we can support the view that our passive portfolios manage to track the target indices and outperform them in every case, and this fact may be regarded as evidence in favor of the applicability of our multi-index model in passive portfolio management.

FIGURE 6.1: INDEX PORTFOLIO VS ASE-60 INDEX



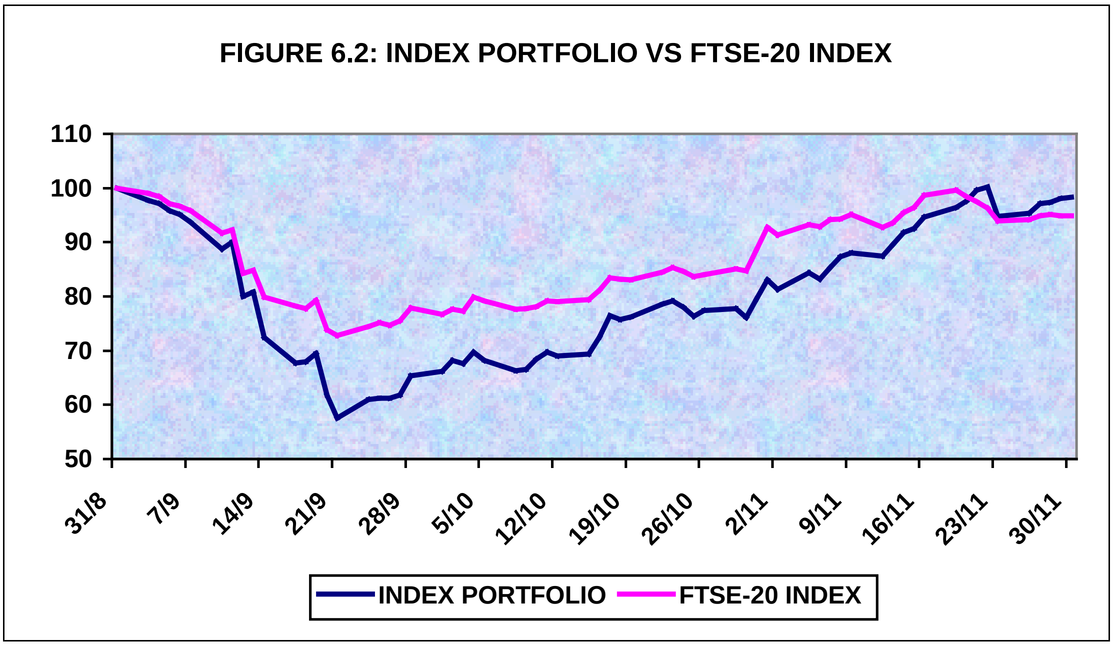


FIGURE 6.2: INDEX PORTFOLIO VS FTSE-20 INDEX
110
100
90
80
70
60
50
31/8
7/9
14/9
21/9
28/9
5/10
12/10
19/10
26/10
2/11
9/11
16/11
23/11
30/11
INDEX PORTFOLIO
FTSE-20 INDEX

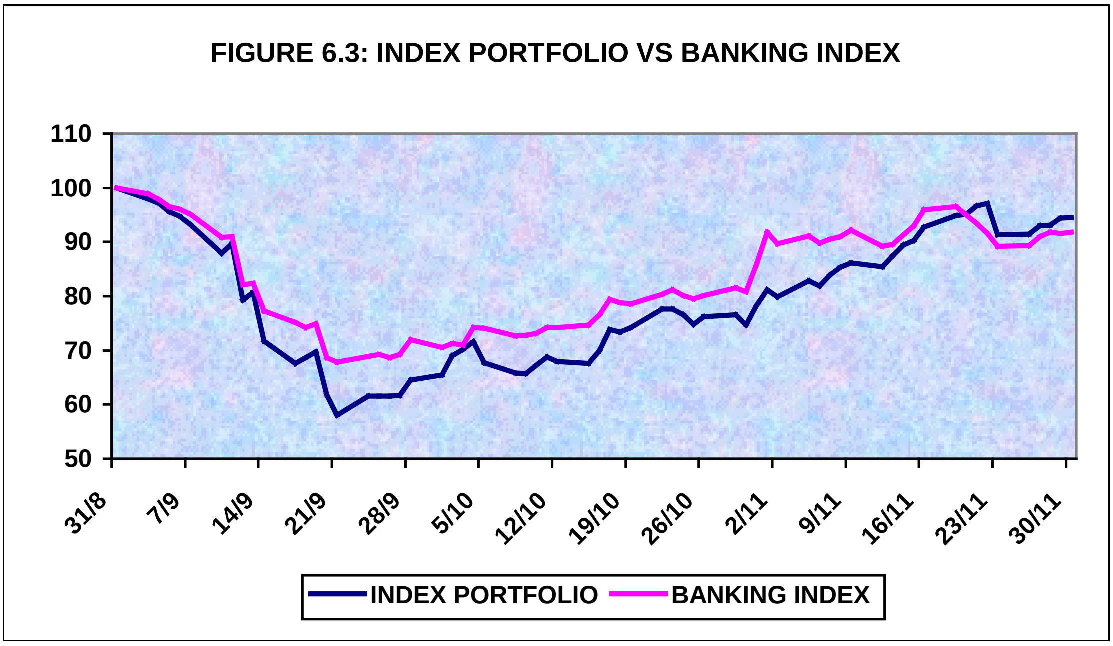


FIGURE 6.3: INDEX PORTFOLIO VS BANKING INDEX
110
100
90
80
70
60
50
31/8
7/9
14/9
21/9
28/9
5/10
12/10
19/10
26/10
2/11
9/11
16/11
23/11
30/11
INDEX PORTFOLIO
BANKING INDEX

FIGURE 6.4: INDEX PORTFOLIO VS INDUSTRIAL INDEX

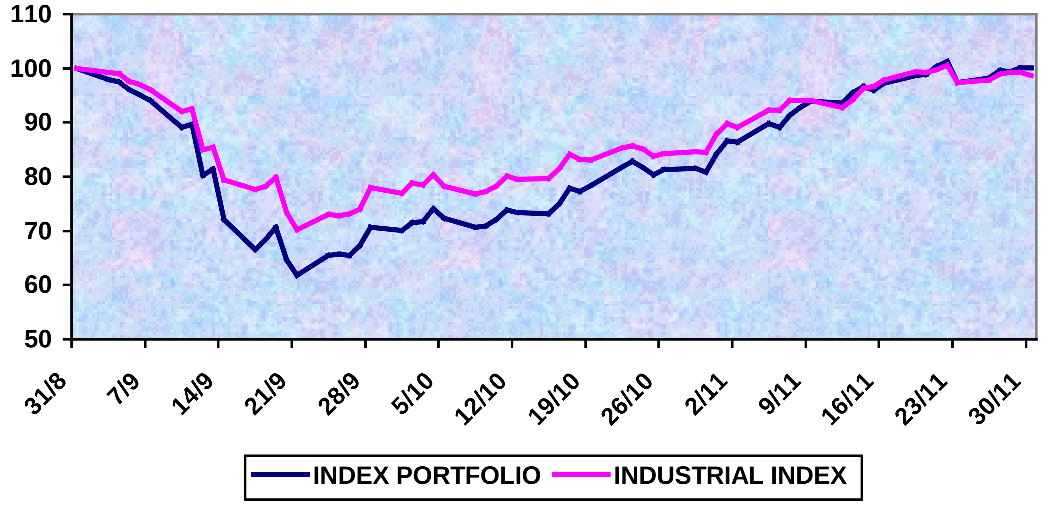
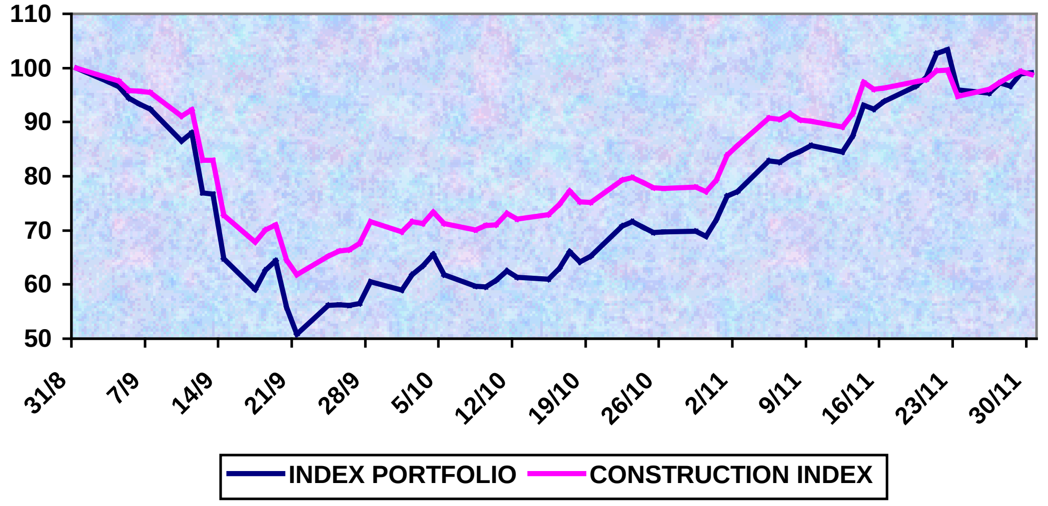


FIGURE 6.5: INDEX PORTFOLIO VS CONSTRUCTION INDEX



6.3 ACTIVE PORTFOLIO MANAGEMENT

The basic idea of active portfolio management is the construction of portfolios with matched risk exposure profiles to that of a benchmark portfolio, for every risk factor except from one, for which we allow a greater or a lower sensitivity in comparison with that of the chosen target index. In other words we make a factor bet and hope to profiteer from unexpected changes in the value of this factor.

An active portfolio strategy is regarded as an ‘aggressive’ strategy and in fact is ‘tilting’. Starting from a normal portfolio, like the ASE-60 Index in our case, we deviate from its risk profile in a controlled way. By tuning the sensitivity coefficients, the various sources of systematic risk are seen as opportunities and we intend to earn excess return from these sources. A crucial condition for adopting an active strategy is that the investor has superior forecasting abilities and can predict factor movements that are unexpected to other investors. For this reason we have made the assumption that the VAR model, estimated in previously in this paper, is the true and unique generating process of surprises in economic factors.

In our analysis we are going to make four factors bets on the following risk sources:

- Default risk
- Inflation risk
- Confidence risk
- Business Cycle risk

We avoid making any ‘tilting’ for the market timing risk, defined as the return on the market portfolio that is not explained from the other risks, because we have not estimated a model which can generate forecasts for this risk factor.

In addition, we form a portfolio by making a combined factor bet. To be more specific, we adjust the risk profile of our portfolios in order to take advantage of unexpected changes in every risk factor. The objective here is to find the optimum combination of exposure to each risk factor, and by assuming higher or lower risk in each case, to outperform the benchmark stock index. As it has been mentioned above, we use the ASE-60 Index as the target index for the construction of our portfolios. Our choice is not made at random. We believe that the ASE-60 index is the more suitable proxy for the market portfolio and a well-diversified portfolio, because it consists of the leading firms traded on the Greek stock market.

The first task in the implementation of active portfolio strategies is to generate ex-post forecasts for the course of our economic factors for two separate months, October and November 2001. We examine the applicability of our multi-factor model in two distinct periods because our VAR model is constructed to generate forecasts on a monthly basis. Furthermore, the selection of this test period is based on the data availability at the time of the performance of these tests. Unexpected surprises are defined as the difference between the actual and the forecasted values of our macrovariables. Our ex-post factor forecasts are easily computed from the VAR model estimated in section 4. After extracting our predictions, we adopt the appropriate factor bet in order to achieve higher returns, with respect to the target index.

The first step in our analysis is the derivation of factor forecasts for the test period. To accomplish it, we use the VAR model estimated in previous section, which is assumed to be the true generating process of surprises in the values of our risk factors. We obtain the actual values of the economic factors for two months prior to October and November, because we have estimated a second-order VAR model, and after transforming them properly (by taking the first logarithms) we compute the value of each risk factor for these two months. In fact, we compute the values of the macrovariables ex-post, firstly for October and secondly for November by using the estimated VAR model. Then, we regard the estimated values as our factor forecasts and by subtracting them from their actual values in each month, we obtain the unexpected changes in our macrovariables. Then, we proceed with the stock grouping according to these ex-post economic surprises. Recall that we do not generate forecasts for the residual market factor because the VAR model includes only the economic variables. We should mention here that we have knowledge of the past values of the risk factors and we try to examine the applicability of our multi-index model in active portfolio management in retrospect. Table 6.5 displays the actual values (obtained from the National Statistical Service), the predicted values (derived from the VAR model), the surprises in the selected risk factors and the adopted strategy for each month.

Table 6.5: Estimation of unexpected changes in risk factors in October and November 2001.

	OCTOBER 2001			
	Default Risk	**Inflation Risk**	**Business Cycle Risk**	**Confidence Risk**
Actual value	0,01312	-0,25131	0,00794	0,01479
Forecasted value	0,00577	-0,02715	0,02046	-0,02547
Unexpected Change	**0,00735**	**-0,22416**	**-0,01252**	**0,04026**
Strategy	**Defensive**	**Aggressive**	**Aggressive**	**Defensive**
	NOVEMBER 2001			

	Default Risk	Inflation Risk	Business Cycle Risk	Confidence Risk
Actual value	-0,00186	-0,15415	0,00919	0,21050
Forecasted value	0,04224	-0,08055	0,00229	-0,08418
Unexpected Change	**-0,04410**	**-0,07360**	**0,00689**	**0,29468**
Strategy	**Aggressive**	**Aggressive**	**Defensive**	**Defensive**

Note: Values are expressed in first logarithms.

It should be very useful to discuss the changes in the stock market and the macroeconomic variables within the test period. To begin with default risk, the spread between lending and deposit rates rapidly increased in October after the terrorist attack in September and slightly shortened in November because of the sharp decline in inflation rates. Business activity continued to grow at a stable rate, while the spread between returns on long- and short-term government bonds increased, due to the smaller decrease in long-term yields compared to these of T-bills. In general, during the third quarter of 2001, Greek economy kept growing steadily and interest rates were lowered further, because of the persistent downward trend in inflation rates. With regard to the stock market, after the sharp decline of stock prices in September due to the terrorist attack on the USA, market participants decided to augment their investments in the Athens Stock Exchange. Consequently, the ASE-60 Index rose by 10,33% and 8,75% in October and November respectively.

To sum up, risk premia, business activity and the spread in the returns on long and short-term bonds rose substantially in October and November, whereas inflation rates decreased further. If we take into consideration the direction of the responsiveness of the majority of Greek firms to the considered economic surprises, we conclude that: 1) an unexpected decline in default and inflation risk should positively affect stock returns, 2) positive shocks in business activity and term structure are expected to have a negative impact on the Greek stock market. The first point is possibly anticipated while the second statement it seems rather ambiguous and we should discuss it. A positive surprise in the time premia implies that investors require higher returns in the long run because they expect inflationary pressures in the future. So, this expectation will normally have a negative effect on stock returns.

A very confusing point is the negative relationship between business cycle and stock prices. It is irrational to find that an unexpected increase in GDP is regarded as bad news by the investors. A possible explanation for this finding is that economy has reached the peak of business cycle and consequently favorable surprises in real production may be interpreted as a sign of inflationary pressures and higher interest rates in the future. We should note here that this relation is owed to the diametrically opposite course of these variables after September 1999. Even though this relation is somewhat ambiguous we will accept it and form our portfolios according to this paradox.

Table 6.5 presents the unexpected changes in each month and the resulting factor bets. To begin with default risk, we will form a portfolio with lower exposure in October and a greater exposure in November in comparison with the ASE-60. In both months we will make an aggressive bet on inflation risk and a defensive one on confidence risk. Finally, we will create a portfolio with a greater sensitivity to business cycle risk in October in relation to the benchmark portfolio and more temperate to this factor in November, even though this strategy seems insensible.

The next step in our analysis is the determination of stock weights in our portfolios, in a way that ensures the matching of their risk sensitivities to those of the target indices. This is a problem of multiple goal programming and its representation is presented above.

1) $\sum_{i=1}^{160} w_i = 1$

2) $w_i \geq 0$

3) $w_1 \times b_{1,j} + w_2 \times b_{2,j} + ... + w_{160} \times b_{160,j} = b_{p,j} = b_{t,j}$

4) $\max / \min(w_1 \times b_{1,j} + w_2 \times b_{2,j} + ... + w_{160} \times b_{160,j}) = b_{p,j}$

5) $w_i \leq 0{,}10$ (optional)

6) $\min[\sigma^2(e_i)] = \min[\sum w_i^2 \sigma^2(e_i)]$

where,

w = weights

i = number of securities , i = 1,2,3,.... ..,160

j = risk factors, j = 1,2,...,5

b_{1j} = exposure (beta) of security 1 on factor j

b_{pj} = exposure (beta) of portfolio p, on factor j

b_{tj} = exposure (beta) of target index t, on factor j

$\sigma^2(e_i)$ = *residual risk*

These constraints do not differ from those imposed on the portfolio formation in passive management, with the exception of the fourth restriction. The meaning of this restriction is to obtain the maximum or the minimum exposure to a specific risk factor while having the same risk betas in relation to the benchmark portfolio. To put it in a different way, our objective here is to outperform the other market participants by making a factor bet. The rest constraints are the same with those described in passive portfolio management and we omit to explain again their role in stock selection.

The last step in our analysis is the evaluation of portfolio performance. Table 6.6 presents the basic characteristics of the active portfolios, being formed according to the above restrictions and the benchmark portfolios. To be more specific, this table displays the total return and the standard deviation of returns of the generated portfolios. The first element gives us a view of the performance of the portfolios under consideration during the investment horizon, while the second one is a measure of the risk assumed in every portfolio. We should mention here that the standard deviation of returns is computed on daily basis and measures the overall risk of our portfolios. The composition of the generated portfolios in active portfolio management is presented in appendix E.

Table 6.6: Characteristics of Portfolios and Targets used in Active Management

Panel A

Portfolios	OCTOBER Total Return	OCTOBER Standard Deviation of Returns	NOVEMBER Total Return	NOVEMBER Standard Deviation of Returns
Bet on default risk	9,92% (5)	1,64%	23,28% (5)	2,55%
Bet on inflation risk	11,01% (13)	1,64%	21,72% (13)	2,61%
Bet on business cycle risk	13,21% (5)	2,54%	10,88% (5)	1,64%
Bet on confidence risk	7,70% (10)	1,53%	14,51% (10)	1,89%
Optimum combination of bets	12,88% (7)	2,53%	28,84% (7)	3,36%

Panel B

Benchmark Portfolio	OCTOBER Total Return	OCTOBER Standard Deviation of Returns	NOVEMBER Total Return	NOVEMBER Standard Deviation of Returns
ASE-60 Index	10,33% (56)	1,26%	8,75% (56)	1,41%

Note: Standard deviations are computed on daily basis. Numbers in parenthesis denotes the number of firms that are included in each portfolio.

As it is apparent from table 6.6, each of the active portfolios are riskier than the benchmark portfolio (the ASE-60 Index). This is to be expected for the portfolios constructed to have a greater sensitivity to one factor but not for the portfolios which exhibit lower exposure to some factors. Recall that the mean-absolute-deviation method, employed here as the measure of portfolio risk, takes into account not only the systematic but also the non-systematic risk owing to the firm specific forces. If we look at table 6.6, we can see the number of securities included in each group. It is obvious that we have managed to form portfolios, which emulate the systematic component of market volatility, with much fewer equities in relation to the benchmark index.

The fact that all our portfolios are subject to greater level of risk can possibly be stemmed from the low degree of diversification and thus the non-systematic risk components. Another interesting point is the higher volatility of the portfolios and the market index in November in comparison with October, mainly because of the instability of international stock markets after the September 11th.

If we focus our attention on the total portfolios' returns, we can notice that our portfolios have achieved to compete the market index in a satisfactory way, especially in November. In particular, we manage to the market index in October in three cases and we marginally fail to attain this goal in one more. The performance of our portfolios is more impressive in November when we beat the market index by far. Also, it is very encouraging the fact that the portfolio with the optimum bet combination achieves the higher aggregated returns during these two months. On the other hand, the results from our bets on confidence risk are very poor in both months. Tables 6.7 and 6.8 summarize the performance of our portfolios in relation to the benchmark stock index in October and November respectively. As we can see, we beat the market index in every case in November while three portfolios have superior performance in October in comparison with the ASE-60 Index.

Table 6.7: Total returns of the active portfolios and the target index in October

Bets on risk factors	Total return of the active portfolios	Total return of the target index (ASE-60)	Final Outcome
Default risk	9,92%	10,33%	**LOSE**
Inflation risk	11,01%	10,33%	**WIN**
Business Cycle risk	13,21%	10,33%	**WIN**
Confidence risk	7,70%	10,33%	**LOSE**
Combined Bets	12,88%	10,33%	**WIN**

Table 6.8: Total returns of the active portfolios and the target index in November

Bets on risk factors	Total return of the generated portfolios	Total return of the target index (ASE-60)	Final Outcome

Default risk	23,28%	8,75%	**WIN**
Inflation risk	21,72%	8,75%	**WIN**
Business Cycle risk	10,88%	8,75%	**WIN**
Confidence risk	14,51%	8,75%	**WIN**
Combined Bets	28,84%	8,75%	**WIN**

As we have previously underlined, the evaluation of the performance of a portfolio must take into account not only the rate of return achieved but also the level of undertaken risk. Since our portfolios exhibit positive returns in the test period, the Sharpe's ratio will help us to estimate the risk-adjusted returns of the active portfolios and the benchmark stock index and make inferences of the performance of the adopted investment strategies. Table 6.9 and 6.10 display the risk- adjusted returns of the active portfolios and the target index in October and November respectively. Keep in mind that we regard the portfolios with the highest risk-adjusted return in algebraic values, as those having achieved the best performance.

Table 6.9: Risk-adjusted returns of the active portfolios and the target index in October

Bets on risk factors	Sharpe's ratio of the generated portfolios	Sharpe's ratio of the target index (ASE-60)	Final Outcome
Portfolio 1 (bet on default risk)	5,866	7,981	LOSE
Portfolio 2 (bet on inflation risk)	6,547	7,981	**LOSE**
Portfolio 3 (bet on business cycle risk)	5,098	7,981	**LOSE**
Portfolio 4 (bet on confidence risk)	4,839	7,981	**LOSE**

Portfolio 5 (optimum combination of bets)	4,977	7,981	**LOSE**

Table 6.10: Risk-adjusted returns of the active portfolios and the target index in November

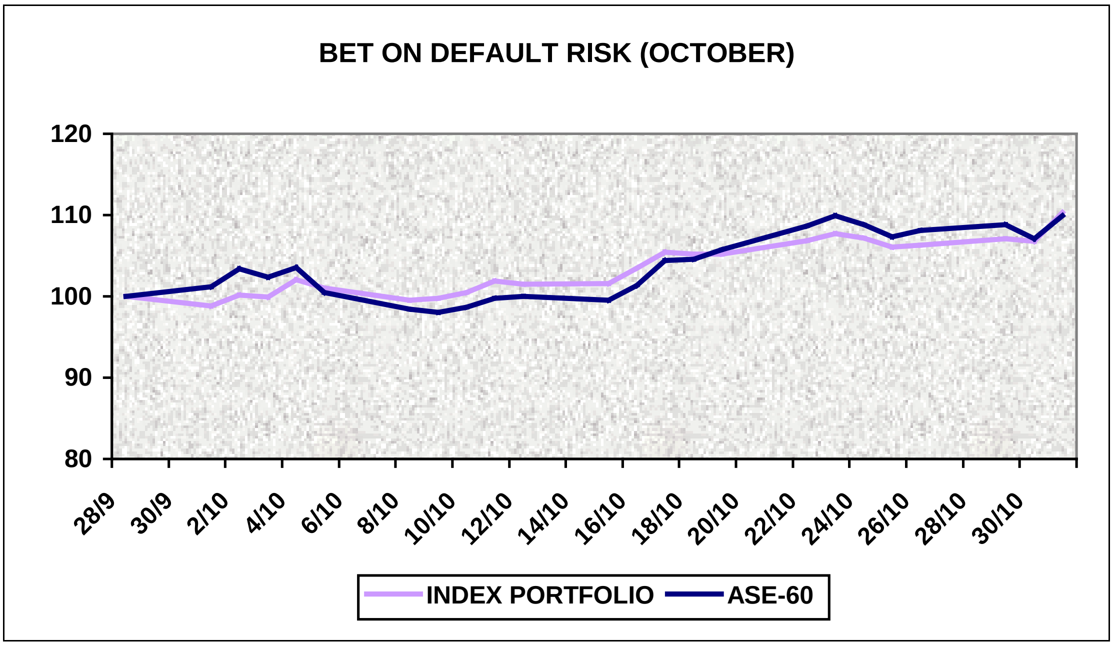
Bets on risk factors	**Sharpe's ratio of the generated portfolios**	**Sharpe's ratio of the target index (ASE-60)**	**Final Outcome**
Portfolio 1 (bet on default risk)	9,025	6,035	WIN
Portfolio 2 (bet on inflation risk)	8,238	6,035	**WIN**
Portfolio 3 (bet on business cycle risk)	6,458	6,035	**WIN**
Portfolio 4 (bet on confidence risk)	7,524	6,035	**WIN**
Portfolio 5 (optimum combination of bets)	8,503	6,035	**WIN**

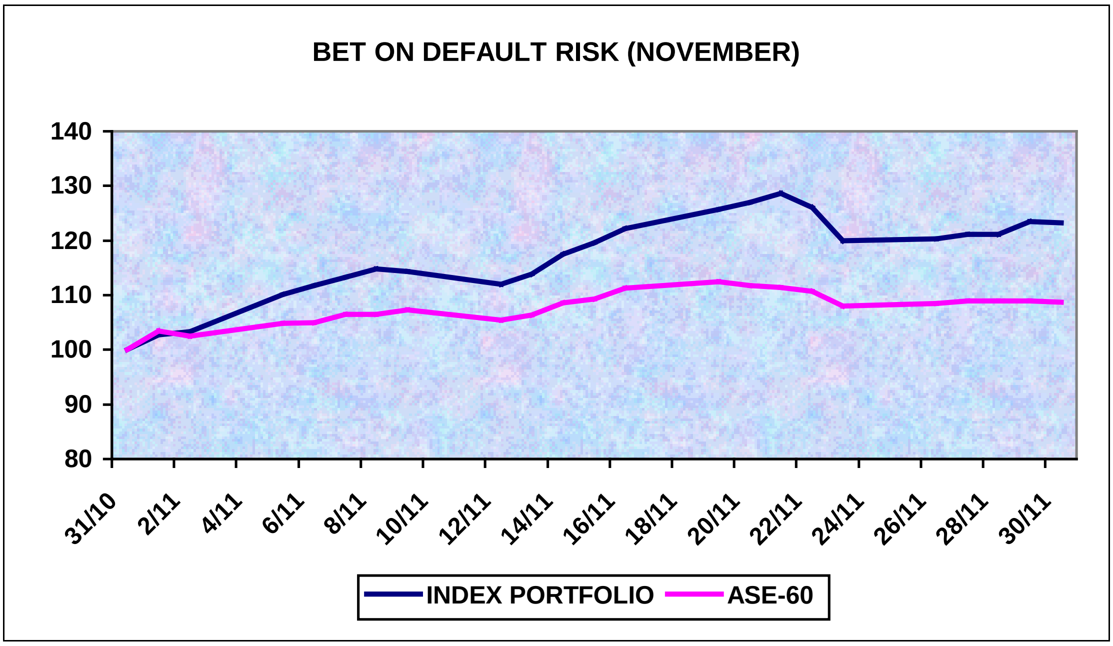
As we can see from tables 6.9 and 6.10, on a risk-adjusted return basis, we accomplish to outperform the market index in every case in November and lose in every case in October. Even though our portfolios achieve to beat the ASE-60 Index in terms of total returns in three cases in October, they fail to attain the same goal when we measure their performance in terms of risk-adjusted returns. This fact is resulted from the higher degree of risk assumed by the active portfolios, especially in this month. On the other hand, the performance of our portfolios is very impressive in November, as it is expressed by their Sharpe's ratios. This finding is owed to the extensive gap between the overall returns of the generated portfolios and the benchmark index that compensates for the higher volatility of the former ones.

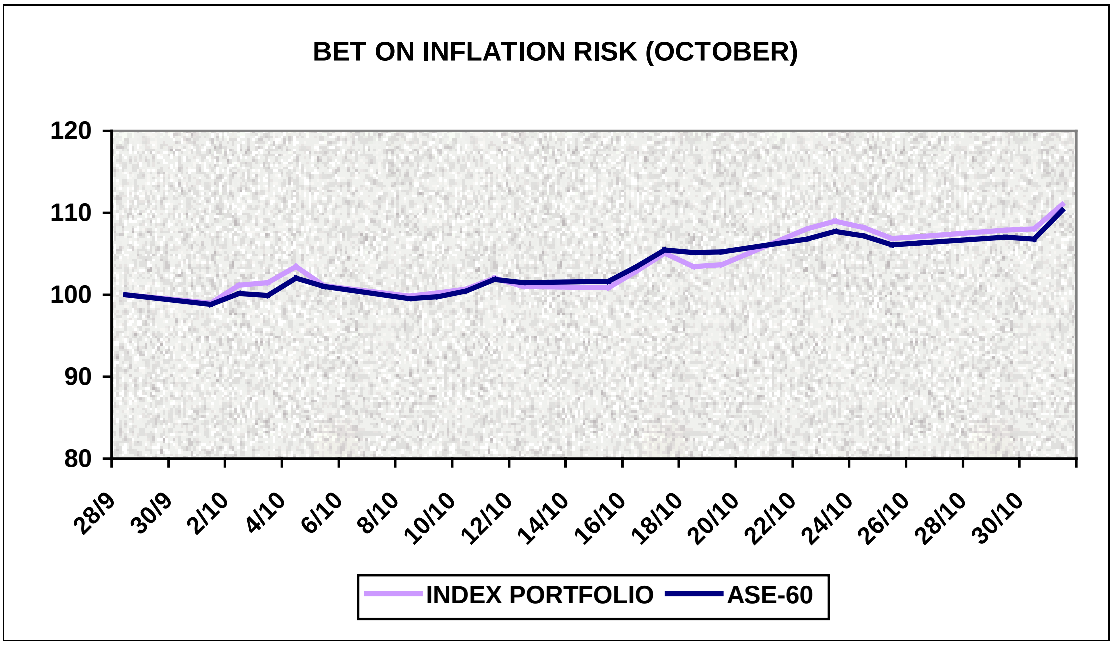
The best portfolio in October is the one constructed to be more sensitive to inflation risk while our "aggressive" bet on default risk exhibits the best risk-return trade-off. On the other hand, our bets on confidence risk in October and on business cycle risk in November has the lower Sharpe's ratio among the other portfolios. A remarkable fact is the superior performance of our bet on business cycle risk in November, in relation to the market index, since we have based our strategy on a paradox fact (we have explained it above).

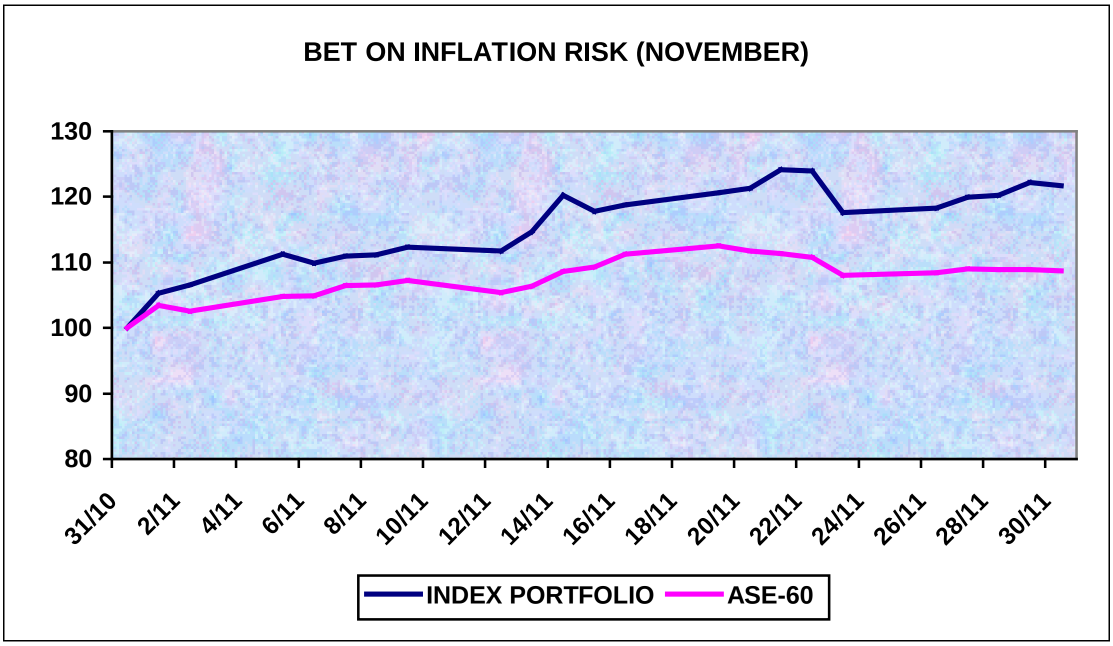
To conclude, the outstanding performance of our portfolios in November is in favor of the applicability of our multi-factor model in active portfolio management. Also, the results of our strategies in terms of total returns are very encouraging for the usefulness of our model. However, the poor performance of the selected investment strategies in October does not allow us to be confident of the reliability of our model. Moreover the short time horizon of our tests, should make us very cautious when judging the applicability of our model in portfolio management.

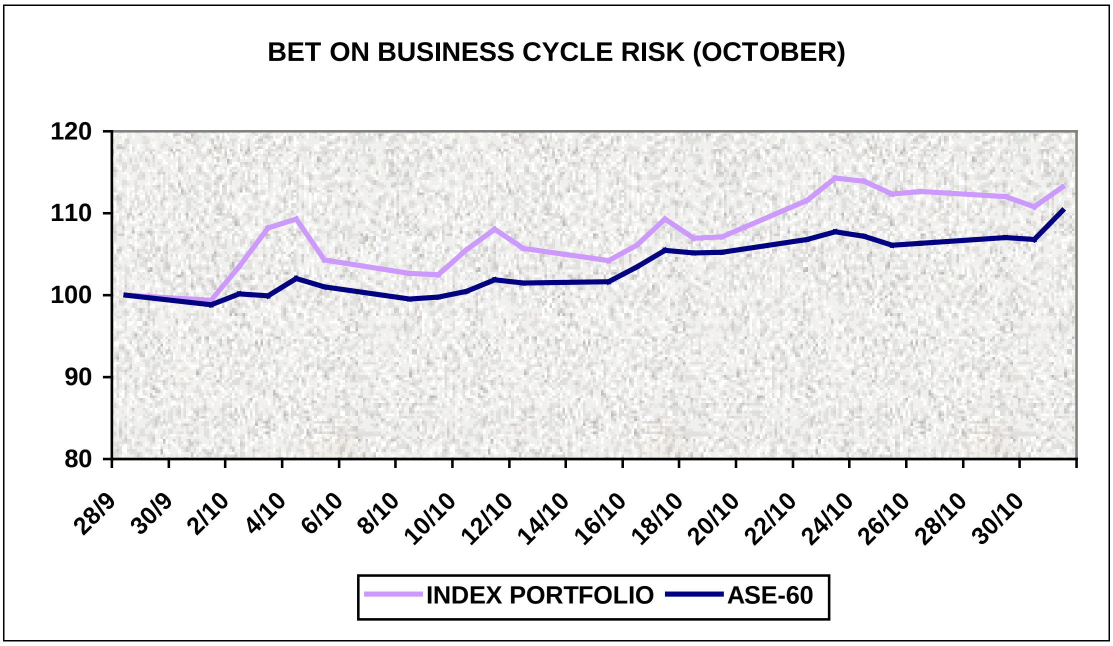
We will complete the description of active portfolio management by displaying the time plot of our index portfolios against that of the target index. In order to make this comparison more distinct, we express daily returns as an index (we have described the way of constructing these indices above). As we can see from the following figures, the constructed index portfolios have managed to track the target indices relatively well and this fact leads us to the conclusion that our estimated multi-index model may be employed in active portfolio management with success.

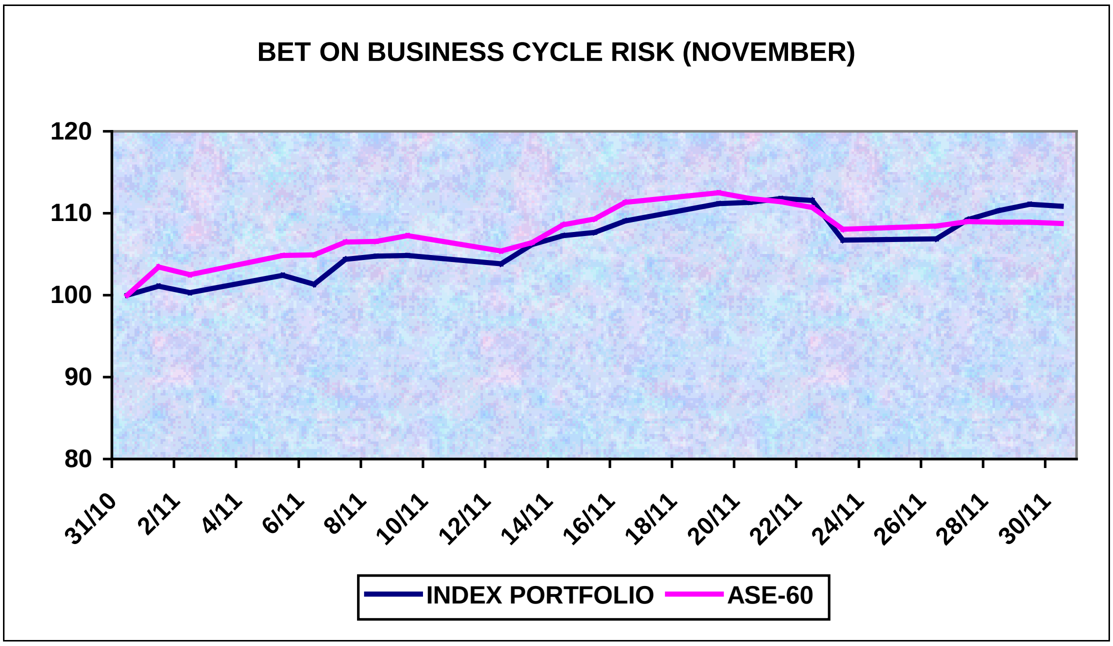


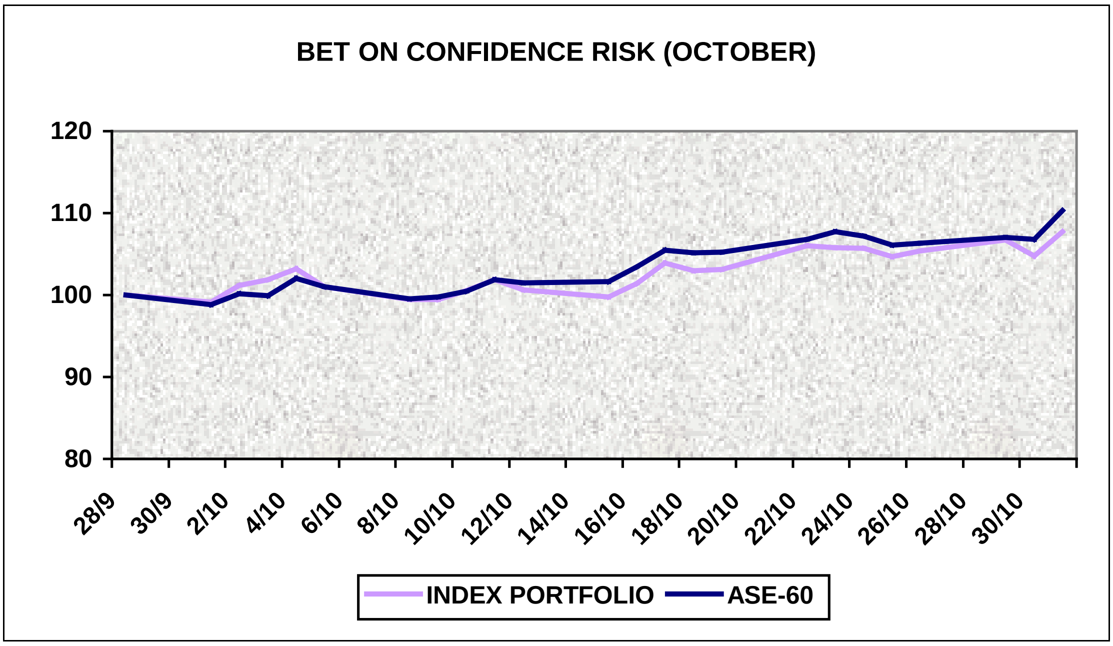

BET ON DEFAULT RISK (NOVEMBER)
140
130
120
110
100
90
80
31/10
2/11
4/11
6/11
8/11
10/11
12/11
14/11
16/11
18/11
20/11
22/11
24/11
26/11
28/11
30/11
INDEX PORTFOLIO
ASE-60

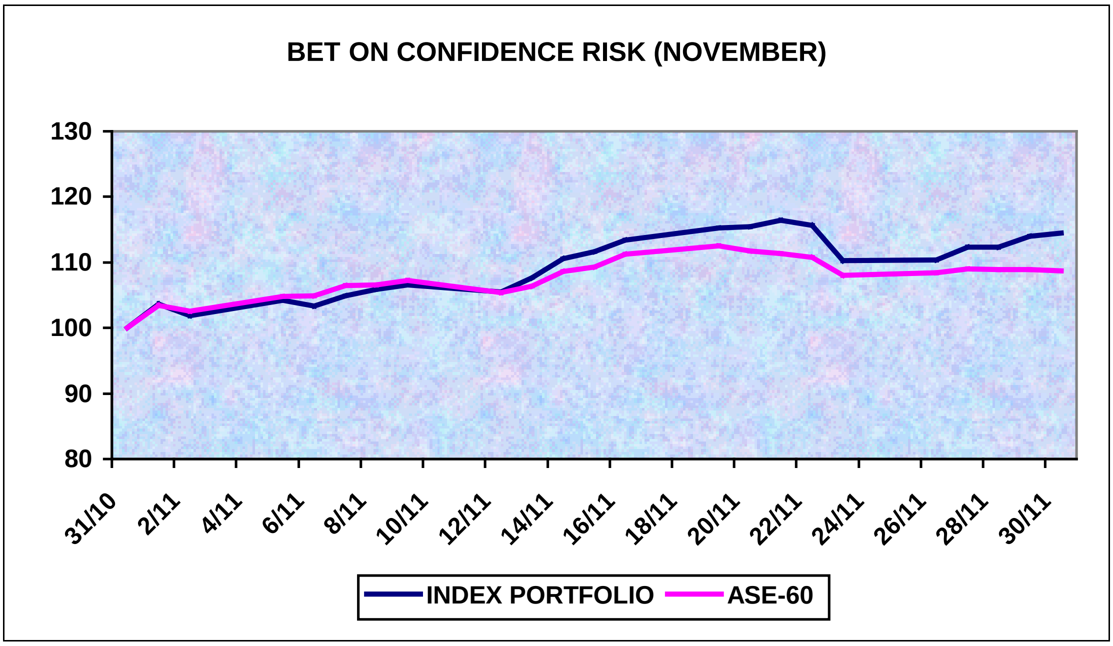

BET ON INFLATION RISK (OCTOBER)
120
110
100
90
80
28/9
30/9
2/10
4/10
6/10
8/10
10/10
12/10
14/10
16/10
18/10
20/10
22/10
24/10
26/10
28/10
30/10
INDEX PORTFOLIO
ASE-60

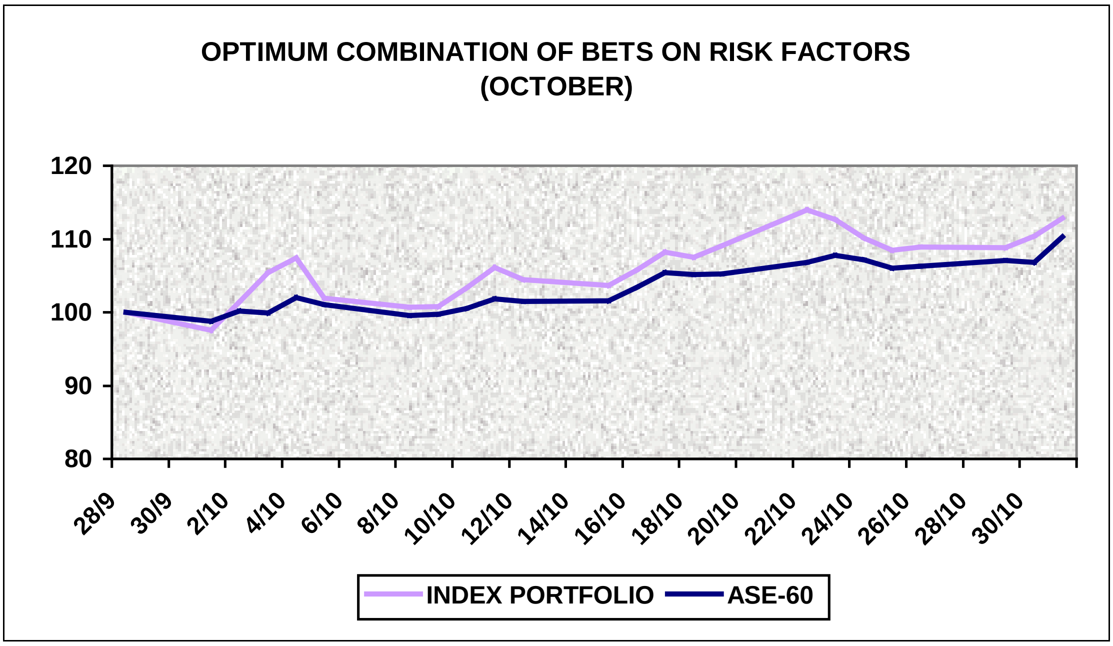

BET ON INFLATION RISK (NOVEMBER)
130
120
110
100
90
80
31/10
2/11
4/11
6/11
8/11
10/11
12/11
14/11
16/11
18/11
20/11
22/11
24/11
26/11
28/11
30/11
INDEX PORTFOLIO
ASE-60

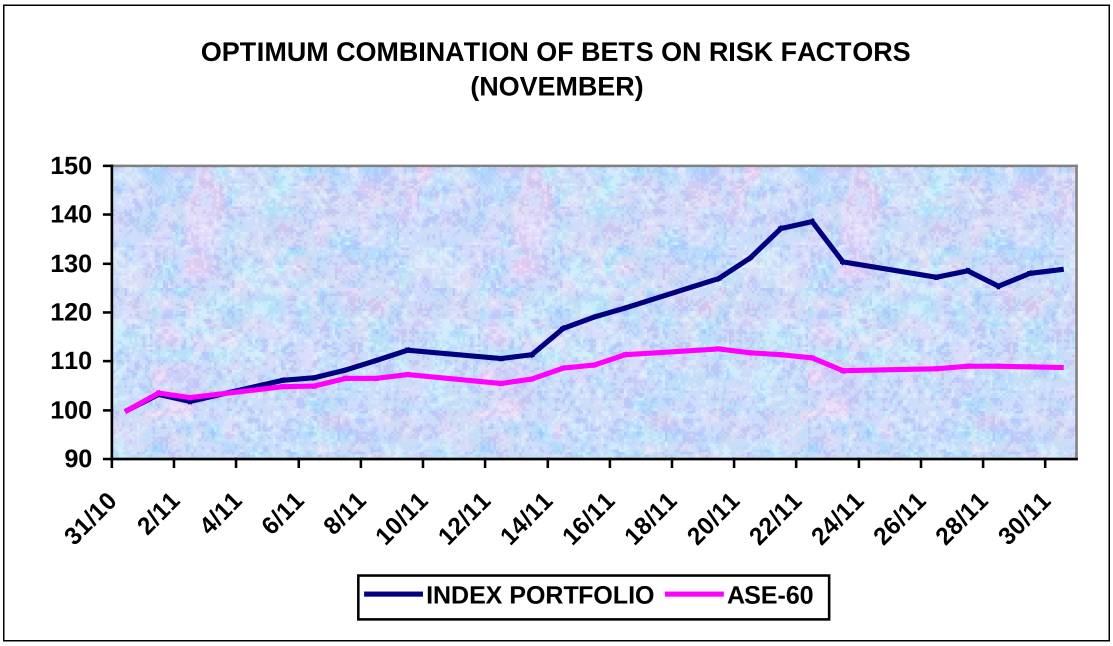

BET ON BUSINESS CYCLE RISK (OCTOBER)
120
110
100
90
80
28/9
30/9
2/10
4/10
6/10
8/10
10/10
12/10
14/10
16/10
18/10
20/10
22/10
24/10
26/10
28/10
30/10
INDEX PORTFOLIO
ASE-60


BET ON BUSINESS CYCLE RISK (NOVEMBER)
120
110
100
90
80
31/10
2/11
4/11
6/11
8/11
10/11
12/11
14/11
16/11
18/11
20/11
22/11
24/11
26/11
28/11
30/11
INDEX PORTFOLIO
ASE-60


BET ON CONFIDENCE RISK (OCTOBER)
120
110
100
90
80
28/9
30/9
2/10
4/10
6/10
8/10
10/10
12/10
14/10
16/10
18/10
20/10
22/10
24/10
26/10
28/10
30/10
INDEX PORTFOLIO
ASE-60


BET ON CONFIDENCE RISK (NOVEMBER)
130
120
110
100
90
80
31/10
2/11
4/11
6/11
8/11
10/11
12/11
14/11
16/11
18/11
20/11
22/11
24/11
26/11
28/11
30/11
INDEX PORTFOLIO
ASE-60


OPTIMUM COMBINATION OF BETS ON RISK FACTORS (OCTOBER)
120
110
100
90
80
28/9
30/9
2/10
4/10
6/10
8/10
10/10
12/10
14/10
16/10
18/10
20/10
22/10
24/10
26/10
28/10
30/10
INDEX PORTFOLIO
ASE-60


OPTIMUM COMBINATION OF BETS ON RISK FACTORS
(NOVEMBER)
150
140
130
120
110
100
90
31/10
2/11
4/11
6/11
8/11
10/11
12/11
14/11
16/11
18/11
20/11
22/11
24/11
26/11
28/11
30/11
INDEX PORTFOLIO
ASE-60

CONCLUSIONS

This study has explored a set of economic state variables as the systematic influences on stock market returns and the applicability of a multi-index in passive and active portfolio management. Based on a previous a work of Burmeister et al (1994) we have selected four macroeconomic variables as the sources of systematic risk (risk premia, inflation, real retail sales, term structure), plus a market risk factor.

We have employed the VAR framework to estimate the expectations generating process of the macrovariables and assumed that this is the true and unique model that describes economic surprises. The generated series of the economic risk factors can be characterized as 'white noise' processes and satisfy the restrictions of APT theory. In order to estimate the market factor risk, we have regressed excess returns on the market portfolio against the four macrovariables and found that these factors explain only 6% of the movements in the market portfolio. From this point, we conclude that economic variables do not affect significantly the course of the Greek stock market and our estimated multi-index model can be regarded as a combination of a single-factor model (market model) plus four economic variables.

The estimation of the factor loadings, used in the portfolio formation, is based on the first-pass of the Fama- McBeth approach. From the first-pass we have computed the sensitivity of individuals firms and sectors to our risk factors. The results from the time-series regressions have revealed that almost 60% of the estimated coefficients for the sectors and 40% for the individual firms are statistically significant and that three factors, retail sales, term structure and residual market, mostly appear to affect stock returns. We also discover that the five risk factors account for 40% to 70% of the variation of returns of individual firms, mainly because of the high explanatory power of the market factor.

In the last part of our analysis, we have examined the applicability of the derived multi-index model in portfolio management. We have constructed 15 portfolios with prespecified risk characteristics and search their ability to track a target index (passive strategy) or outperform the market (active strategy). In order to judge their performance, we have taken into account risk-adjusted returns.

To begin with passive portfolio management, our index portfolios have managed to beat the benchmark stock indices in every case, both in terms of absolute and risk-adjusted returns. The main drawback is that our portfolios are subject to greater risk, because of firm-specific forces. But in general, we can argue that our multi-factor model can adequately be employed in passive portfolio management.

In the implementation of active strategies we have formed portfolios according to four bets, one for each economic factor, and an optimum combination of risk exposures to these economic variables and for two different periods, October and November 2001. In active portfolio management though, the performance of our multifactor model is ambiguous. To be more specific, the active portfolios exhibit a great performance in November, while in October the results are rather disappointing.

If we evaluate the performance of the active portfolios in terms of risk adjusted returns, we can see that they have achieved to beat the market index in November but in October they have been inferior to the ASE-60 Index in every case.

On the other hand, it is very encouraging the fact that, in terms of total returns, our portfolios outperform the market index in three cases in October and in every case in November. On the balance, we can’t claim that the estimated multi-index model can be used in active portfolio management with definite success.

To summarize, the results presented in this work show that it is possible to develop a macroeconomic variable model for the Greek stock market, which satisfies the restrictions of APT theory. Moreover, the estimated multi-factor model can be used in portfolio management with considerable success, especially in the implementation of passive investment strategies.

BIBLIOGRAPHY

1. Burmeister Edwin, Roll Richard and Ross Stephen, ''A Practitioner's Guide to Arbitrage Pricing Theory.'' In a Practitioner's Guide to Factor Models, The Research Foundation of the Institute of Chartered Financial Analysts, Charlottesville, (1994), pp. 1-30
2. Burmeister Edwin, Roll Richard and Ross Stephen, ''Using Macroeconomic Factors to Control Portfolio Risk.'' BIRR Portfolio Analysis, Inc
3. Chen Su-Jane, Bradford Jordan, '' Some Empirical Tests in the Arbitrage Pricing Theory.'' Journal of Banking and Finance, 17, pp. 65-89 (1993).
4. Chen Nai-Fu, Roll Richard and Ross Stephen, "Economic Forces and the Stock Market", Journal of Business, vol. 59, pp. 383-403 (1986)
5. Priestley Richard, "The arbitrage pricing theory, macroeconomic and financial factors, and expectations generating processes". Journal of Banking and Finance, vol. 20, pp. 869-890, (1996)
6. Antoniou Antonios, Garrett Ian, Priestley Richard, "Macroeconomic variables as a common pervasive risk factors and the empirical content of the arbitrage pricing theory ". Journal of Empirical Finance, vol. 5, pp. 221-240, (1998).
7. Ross Stephen, "The Arbitrage Theory of Capital Assets Pricing". Journal of Economic Theory, vol. 13, pp. 341-360, (1976)
8. Roll Richard and Stephen Ross, "An Empirical Investigation of the Arbitrage Pricing Theory". Journal of Finance, 35, pp. 1073-1103, (1980).
9. Fama Eugene, French Kenneth "The Cross Section of Expected Stock Returns", Journal of Finance, 47, No.2 (June 1992), pp. 427-466.
10. Fama Eugene, French Kenneth "Common Risk Factors in the Returns on Stocks and Bonds", Journal of Financial Economics, 33 (1993), pp. 3-56.
11. Fama Eugene, MacBeth James. "Risk, Return and Equilibrium: Empirical Tests", Journal of Political Economy, 81 (1973), pp.607-636.
12. Lehmann Bruce, Modest David "The Empirical Foundations of the Arbitrage Pricing Theory I: The Empirical Tests", Journal of Financial Economics, 21 (1988), pp. 213-254.
13. Burmeister Edwin, McElroy Marjorie, "Joint Estimation of Factor Sensitivities and Risk Premia for the Arbitrage Pricing Theory". Journal of Finance, 43, No. 3, pp. 721-733, (July 1998).
14. Berry Michael, Burmeister Edwin, McElroy Marjorie. "Sorting out Risks Using Known APT Factors ", Financial Analysts Journal (March 1988), pp.29-42.
15. Διακογιάννης Γεώργιος, Τσιριτάκης Μανώλης, "Μακροοικονομικοί παράγοντες και οι αποδόσεις των μετοχών του Χρηματιστηρίου Αξιών Αθηνών". Δελτίο Τραπέζης Πίστεως, (1997)
16. Keran Michael, "Expectations, Money and the Stock Market", Review, Federal Reserve Bank of St Louis, January 1971.

17. Coggin Daniel, Doukas John, Bala Arshanapalli, "Multifactor Asset Pricing Analysis of International Value Investment Strategies". Journal of Portfolio Management, vol. 24, No. 4 pp. 10-22, (1998).

18. Jaap Spronk, Winfried Hallerbach, "Financial modeling: Where to go? With an illustration for portfolio management". European Journal of Operational Research, vol. 99, pp.113-125, (1997).
19. Michael Brennan, Tarun Chordia, Ananidhar Subrahmanyam, "Alternative factor specifications, security characteristics and the cross-section of expected stock returns". Journal of Financial Economics, vol. 49, pp. 345-373 (1998).
20. Diacogiannis George, "Financial Management. A Modeling Approach Using Spreadsheets ",1st Edition, McGraw-Hill Book Company (1994)
21. Elton Edwin, Gruber Martin, "Modern Portfolio Theory and Investment Analysis", 5th Edition, New York: John Wiley and Sons Inc., (1995)
22. Sharpe William, "Investments", Prentice Hall (1981)
23. Haugen Robert. "Modern Investment Theory", 2nd Edition, Prentice-Hall International Inc. (1990)
24. Huang Stanley. "Investment Analysis and Management". Winthrop Publishers Inc. (1981)
25. Judge George, Hill Carter, Griffiths William, Lutkepohl Helmut, Tsoung-Chao Lee, "Introduction to the Theory and Practice of Econometrics', 2nd Edition, John Wiley & Sons, (1988).
26. Chatfield Chris "The Analysis of Time Series: An Introduction", 5th Edition, Chapman & Hill, (1996).
27. Maddala G.S, In-Moo Kim. "Unit Roots Cointegration and Structural Changes", Cambridge University Press, (1998).
28. Enders Walter, "Applied Econometric Time Series" John Wiley & Sons, (1995).
29. Mills Terence. "The Econometric Modeling of Financial Time Series", Cambridge University Press (1997)

APPENDIX

Appendix A: Sample of Firms

Appendix B: Portfolios used in APT Estimation

Appendix C: Firms' Sensitivities to Risk Factors

Appendix D: Passive Management Portfolios

Appendix E: Active Management Portfolios

APPENDIX A: SAMPLE OF FIRMS

No	FIRM	DATE OF ENTRY	SECTOR
1	ALBIO HOLDINGS SA	12/11/1990	HOLDINGS
2	ALFA ALFA HOLDINGS SA	3/5/1990	HOLDINGS
3	ALPHA BANK SA	1/1/1985	BANKS
4	ALPHA LEASING SA	17/8/1987	LEASING COMPANIES
5	AXON SA HOLDING	15/6/1994	HOLDINGS
6	CHIPITA INTERNATIONAL SA	30/6/1994	FOOD
7	COCA-COLA HELLENIC BOTTLING COMPANY SA	15/7/1991	BEVERAGES
8	ELBISCO HOLDING SA	10/10/1994	HOLDINGS
9	ELMEC SPORT SA	28/2/1991	WHOLESALE TRADE
10	FANCO SA	31/12/1993	CLOTHING
11	FINTEXPORT	1/1/1985	TEXTILES
12	GOODY'S SA	29/12/1994	RESTAURANTS
13	HELLAS CAN PACKAGING MANUFACTURERS SA	7/1/1992	METAL PRODUCTS
14	INFORM LYCOS	25/7/1994	PUBLISHING
15	INTRACOM SA	28/6/1990	ELECTRONIC EQUIPMENT
16	METROLIFE SA	30/12/1994	INSURANCE
17	MICROMEDIA BRITANNIA SA	30/5/1990	WHOLESALE TRADE
18	MULTIRAMA SA	1/1/1985	RETAIL TRADE
19	NEXANS HELLAS SA	12/3/1990	CABLES
20	RIDENCO SA	28/5/1991	WHOLESALE TRADE
21	RILKEN SA	29/4/1991	CHEMICALS
22	SATO SA	15/6/1990	FURNITURE
23	DELTA SINGULAR SA	4/5/1994	INFORMATION TECHNOLOGY
24	APLHA-BETA VASSILOPOULOS SA	26/11/1990	RETAIL TRADE
25	AVAX SA CONSTRUCTION CO	24/8/1994	CONSTRUCTION
26	AEGEK SA	29/11/1993	CONSTRUCTION
27	AKTOR SA TECHNICAL COMPANY	29/12/1993	CONSTRUCTION
28	ALLATINI IND. & COM. CO	1/1/1985	WHOLESALE TRADE
29	ALUMINIUM OF GREECE SA	1/1/1985	METALS
30	ALTE TECHNICAL COMPANY	9/1/1995	CONSTRUCTION
31	SILVER & BARYTE ORES MINING CO	16/12/1994	MINING
32	ASPIS PRONOIA GENERAL INSURANCES SA	1/1/1985	INSURANCE
33	ATTIKAT SA	7/7/1994	CONSTRUCTION
34	BIOSSOL SA	1/1/1985	METAL PRODUCTS
35	VIOTER SA	1/1/1985	CONSTRUCTION
36	VIOHALCO	1/1/1985	HOLDINGS
37	VIS CONTAINER MANUFACTORING CO	1/1/1985	PAPER
38	GENERAL COMMERCIAL & INDUSTRIAL SA	24/7/1990	WHOLESALE TRADE
39	GENERAL CONSTRUCTION COMPANY	11/7/1994	CONSTRUCTION
40	GEKAT CONSTRUCTION COMPANY	29/8/1994	CONSTRUCTION
41	GENERAL HELLENIC BANK	1/1/1985	BANKS
42	GNOMON CONSTRUCTION CO. SA	4/5/1994	CONSTRUCTION
43	DARING S.A.I.N.	8/7/1991	METALS
44	DELTA HOLDINGS SA	29/10/1990	HOLDINGS
45	DIEKAT SA	9/12/1994	CONSTRUCTION

No	FIRM	DATE OF ENTRY	SECTOR
46	HELLENIC SUGAR INDUSTRY SA	30/8/1993	FOOD
47	EGNATIA BANK SA	17/7/1991	BANKS
48	EDRASIS-PSALLIDAS SA	14/11/1994	CONSTRUCTION
49	N.B.G. REAL ESTATE DEVELOPMENT	1/1/1985	REAL ESTATE
50	ETHNIKI GREEK GENERAL INSURANCE COMPANY	1/1/1985	INSURANCE
51	NATIONAL BANK OF GREECE	1/1/1985	BANKS
52	EKTER SA	23/11/1994	CONSTRUCTION
53	ELAIS OLEAGINOUS PROD. SA	1/1/1985	FOOD
54	HELLENIC CABLES SA	16/11/1994	CABLES
55	HELLENIC FABRICS SA	25/10/1994	TEXTILES
56	HELLENIC TECHNODOMIKI SA	20/4/1994	CONSTRUCTION
57	ELTRAK SA	20/8/1991	WHOLESALE TRADE
58	ELFICO SA	28/8/1987	TEXTILES
59	COMMERCIAL BANK OF GREECE	1/1/1985	BANKS
60	SELECTED TEXTILE INDUSTRIES ASSOCIATION SA	15/4/1991	TEXTILES
61	HELLENIC EXCHANGES SA	14/6/1990	HOLDINGS
62	ERGAS SA	23/6/1994	CONSTRUCTION
63	N.I.B.I.D.	1/1/1985	BANKS
64	ETEM SA LIGHT METALS INDUSTRY	9/6/1994	METALS
65	ETMA RAYON	1/1/1985	CHEMICALS
66	EUROPEAN TECHNICAL SA	6/6/1994	CONSTRUCTION
67	ZAMPA SA	1/1/1985	WHOLESALE TRADE
68	HERACLES GENERAL CEMENT COMPANY	31/12/1987	INDUSTRIAL MINERALS
69	THEMELIODOMI SA	13/12/1993	CONSTRUCTION
70	ATHENS MEDICAL C.S.A.	29/8/1991	HEALTH
71	IONIAN HOTEL ENTERPRISES SA	1/1/1985	HOTELS
72	HIPPOTOUR SA	1/1/1985	FARMING
73	KALPINIS-SIMOS STEEL SERVICE CENTER	30/8/1990	WHOLESALE TRADE
74	KARELIA TOBACCO COMPANY INC SA	1/1/1985	TOBACCO
75	KATSELIS SA BREAD INDUSTRY	19/11/1990	FOOD
76	KEKROPS HOTEL TOURIST. BUILD.	1/1/1985	REAL ESTATE
77	KERAMIA-ALLATINI	1/1/1985	INDUSTRIAL MINERALS
78	KLONATEX GROUP OF COMPANIES	1/1/1985	HOLDINGS
79	NAOUSSA SPINNING MILLS SA	14/6/1994	TEXTILES
80	KRE.KA SA	5/12/1994	FOOD
81	LAPSA HOTEL CO	1/1/1985	HOTELS
82	LANAKAM SA	1/1/1985	TEXTILES
83	LEVEDERIS SA	1/1/1985	METAL PRODUCTS
84	LOULIS MILLS SA	6/6/1990	FOOD
85	MAILLIS SA	16/6/1994	METALS
86	MESOCHORITIS BROS	10/8/1994	CONSTRUCTION
87	METKA SA	1/1/1985	METALS
88	MICHANIKI SA	19/7/1990	CONSTRUCTION
89	MOUZAKIS SA	29/3/1991	TEXTILES
90	MOCHLOS SA	8/8/1994	CONSTRUCTION

No	FIRM	DATE OF ENTRY	SECTOR
91	BALAFAS SA	1/1/1985	HOLDINGS
92	UNCLE STATHIS SA	24/6/1991	FOOD
93	BENRUBI SA	5/6/1990	WHOLESALE TRADE
94	BITROS HOLDING SA	13/3/1990	HOLDINGS
95	BOUTARIS & SON HOLDING SA	14/12/1987	HOLDINGS
96	NIKAS SA	22/4/1991	FOOD
97	PAPASTRATOS CIGARETTE CO	1/1/1985	TOBACCO
98	PAVLIDES CONFECTIONARY SA	1/1/1985	FOOD
99	BANK OF PIRAEUS SA	1/1/1985	BANKS
100	PETZETAKIS SA	1/1/1985	PLASTICS
101	CYCLON HELLAS SA	17/12/1990	PLASTICS
102	PROODEFTIKI TECHNICAL COMPANY	16/12/1993	CONSTRUCTION
103	RADIO ATHENAI SA	1/1/1985	RETAIL TRADE
104	METAL INDUSTRY OF ARCADIA C. ROKAS SA	27/8/1990	METAL PRODUCTS
105	SANYO HELLAS HOLDING SA	27/8/1991	HOLDINGS
106	SARANTIS SA	4/7/1994	WHOLESALE TRADE
107	C.I. SARANTOPOULOS SA	3/8/1994	CONSTRUCTION
108	SHELMAN	28/3/1988	WOOD
109	SELONTA AQUACULTURES SA	24/6/1994	FISH FARMING
110	SIGALAS SA	14/12/1994	CONSTRUCTION
111	SIDENOR STEEL PRODUCTS MANUFACTURING COMPANY SA	12/12/1994	METALS
112	STRINTZIS LINES	17/6/1994	PASSENGER SHIPPING
113	TERNA SA	20/1/1994	CONSTRUCTION
114	VOLOS TECHNICAL COMPANY	3/2/1994	CONSTRUCTION
115	TECHNICAL OLYMPIC SA	6/4/1994	CONSTRUCTION
116	PIPE WORKS GIRAKIAN PROFIL SA	29/8/1990	METALS
117	TILETIPOS SA	18/8/1994	TELEVISION
118	TITAN CEMENT CO SA	1/1/1985	INDUSTRIAL MINERALS
119	BANK OF GREECE	1/1/1985	BANKS
120	THE PHOENIX GREEK GENERAL INSURANCE	1/1/1985	INSURANCE
121	FOURLIS SA	21/4/1988	HOLDINGS
122	CHATZIIOANNOU HOLDINGS SA	31/12/1991	HOLDINGS
123	ALTEC CA	2/8/1995	INFORMATION TECHNOLOGY
124	FLEXOPACK SA PLASTICS	2/4/1996	PLASTICS
125	JUMBO SA	19/6/1997	RETAIL TRADE
126	LAMDA DEVELOPMENT SA	25/9/1995	HOLDINGS
127	LAVIPHARM SA	8/11/1995	WHOLESALE TRADE
128	NOTOS COM HOLDINGS SA	24/7/1996	HOLDINGS
129	YALCO-CONSTANTINOU SA	13/11/1995	WHOLESALE TRADE
130	THE HOUSE OF AGRICULTURE SPIROU SA	28/7/1997	WHOLESALE TRADE
131	ATHENA HELL. ENG. IND. & TOUR. CO	30/11/1995	CONSTRUCTION
132	ALCO HELLAS SA	10/2/1997	METALS
133	ATEMKE SA	4/4/1996	CONSTRUCTION
134	VERNICOS YACHTS SHIPPING AND HOLDINGS SA	24/9/1996	TRANSPORT SERVICES
135	GENER SA	18/3/1996	CONSTRUCTION

No	FIRM	DATE OF ENTRY	SECTOR
136	ELVAL HELLENIC ALUMINIUM INDUSTRY SA	10/6/1996	METALS
137	ELVE SA	10/7/1995	CLOTHING
138	HELLATEX SA SYNTHETIC YARNS	19/3/1996	CHEMICALS
139	ESHA SA	6/11/1995	INDUSTRIAL MINERALS
140	EFKLEIDIS SA	8/7/1997	CONSTRUCTION
141	EUROPEAN RELIANCE GEN. INS. SA	29/4/1997	INSURANCE
142	TECHNODOMI TRAVLOS BROS	9/12/1996	CONSTRUCTION
143	IMPERIO SA	19/8/1996	TRANSPORT SERVICES
144	INTERTECH SA	9/10/1995	INFORMATION TECHNOLOGY
145	CARDASSILARIS - CARDICO SA	9/10/1996	WHOLESALE TRADE
146	TEXTILE IND NAFPAKTOS	8/7/1996	TEXTILES
147	KNITWEAR FACTORY MAXIM PERTSINIDIS SA	31/5/1995	TEXTILES
148	MEAGA HOLDINGS SA	18/8/1995	HOLDINGS
149	MYTILINEOS HOLDINGS SA	31/7/1995	WHOLESALE TRADE
150	MARITIME COMPANY OF LESVOS	28/8/1995	PASSENGER SHIPPING
151	NIREFS SA	29/3/1995	FISH FARMING
152	HELLENIC TELECOM. ORGANIZATION	19/4/1996	TELECOMMUNICATIONS
153	PAIRIS SA	8/1/1997	PLASTICS
154	PIRAEUS LEASING	28/12/1995	LEASING COMPANIES
155	THRACE PLASTICS Co SA	26/6/1995	TEXTILES
156	POULIADIS ASSOCIATES CORPORATION	3/7/1996	INFORMATION TECHNOLOGY
157	RADIO KORASIDIS COMMERCIAL	26/3/1996	RETAIL TRADE
158	SFAKIANAKIS SA	18/6/1997	MOTOR VEHICLE
159	TASOGLOU SA - DELONGHI	7/3/1996	WHOLESALE TRADE
160	HALCOR SA METAL WORKS	27/12/1996	METALS

APPENDIX B: PORTFOLIOS USED IN APT ESTIMATION

CRITERION 1: FIRM'S ALPHABETICAL ORDER (IN GREEK CHARACTERS)

	PORTFOLIO 1
No	FIRM
1	ALBIO HOLDINGS SA
2	ALFA ALFA HOLDINGS SA
3	ALPHA BANK SA
4	ALPHA LEASING SA
5	AXON SA HOLDING
6	CHIPITA INTERNATIONAL SA
7	COCA-COLA HELLENIC BOTTLING COMPANY SA
8	ELBISCO HOLDING SA
9	ELMEC SPORT SA
10	FANCO SA
11	FINTEXPORT
12	GOODY'S SA
13	HELLAS CAN PACKAGING MANUFACTURERS SA
14	INFORM LYCOS
15	INTRACOM SA
16	INTRASOFT SA
17	METROLIFE SA
18	MICROMEDIA BRITANNIA SA
19	MULTIRAMA SA
20	NEXANS HELLAS SA
21	RIDENCO SA
22	RILKEN SA
23	SATO SA
24	DELTA SINGULAR SA
25	STABILTON SA

	PORTFOLIO 2
No	FIRM
1	APLHA-BETA VASSILOPOULOS SA
2	AVAX SA CONSTRUCTION CO
3	AEGEK SA
4	ATHENIAN CAPITAL HOLDINGS SA
5	AKTOR SA TECHNICAL COMPANY
6	ALLATINI IND. & COM. CO
7	ALUMINIUM OF GREECE SA
8	ALTE TECHNICAL COMPANY
9	SILVER & BARYTE ORES MINING CO
10	ASPIS PRONOIA GENERAL INSURANCES
11	ATTIKAT SA
12	BIOSSOL SA
13	VIOTER SA
14	VIOHALCO
15	VIS CONTAINER MANUFACTORING CO
16	GENERAL COMMERCIAL & INDUSTRIAL SA
17	GENERAL CONSTRUCTION COMPANY
18	GEKAT CONSTRUCTION COMPANY
19	GENERAL HELLENIC BANK
20	GNOMON CONSTRUCTION CO. SA
21	DARING S.A.I.N.
22	DELTA HOLDINGS SA
23	DIEKAT SA
24	HELLENIC SUGAR INDUSTRY SA
25	EGNATIA BANK SA

	PORTFOLIO 3
No	FIRM
1	EDRASIS-PSALLIDAS SA
2	N.B.G. REAL ESTATE DEVELOPMENT CO
3	ETHNIKI GREEK GENERAL INSURANCE COMPANY
4	NATIONAL BANK OF GREECE
5	EKTER SA
6	ELAIS OLEAGINOUS PROD. SA
7	HELLENIC CABLES SA
8	HELLENIC FABRICS SA
9	HELLENIC TECHNODOMIKI SA
10	ELTRAK SA
11	ELFICO SA
12	COMMERCIAL BANK OF GREECE
13	SELECTED TEXTILE INDUSTRIES ASSOCIATION SA
14	HELLENIC EXCHANGES SA
15	ERGAS SA
16	N.I.B.I.D.
17	ETEM SA LIGHT METALS INDUSTRY
18	ETMA RAYON
19	EUROPEAN TECHNICAL SA
20	ZAMPA SA
21	HERACLES GENERAL CEMENT COMPANY
22	THEMELIODOMI SA
23	ATHENS MEDICAL C.S.A.
24	IONIAN HOTEL ENTERPRISES SA
25	HIPPOTOUR SA

	PORTFOLIO 4
No	FIRM
1	KALPINIS-SIMOS STEEL SERVICE CENTER
2	KARELIA TOBACCO COMPANY INC SA
3	KATSELIS SA BREAD INDUSTRY
4	KEKROPS HOTEL TOURIST. BUILD.
5	KERAMIA-ALLATINI
6	KLONATEX GROUP OF COMPANIES SA
7	NAOUSSA SPINNING MILLS SA
8	KRE.KA SA
9	LAPSA HOTEL CO
10	LANAKAM SA
11	LEVEDERIS SA
12	LOULIS MILLS SA
13	MAILLIS SA
14	MESOCHORITIS BROS
15	METKA SA
16	MICHANIKI SA
17	MOUZAKIS SA
18	MOCHLOS SA
19	BALAFAS SA
20	UNCLE STATHIS SA
21	BENRUBI SA
22	BITROS HOLDING SA
23	BOUTARIS & SON HOLDING SA
24	NIKAS SA
25	PAPASTRATOS CIGARETTE CO

	PORTFOLIO 5
No	FIRM
1	PAVLIDES CONFECTIONARY SA
2	BANK OF PIRAEUS SA
3	PETZETAKIS SA
4	CYCLON HELLAS SA
5	PROODEFTIKI TECHNICAL COMPANY
6	RADIO ATHENAI SA
7	METAL INDUSTRY OF ARCADIA C. ROKAS
8	SANYO HELLAS HOLDING SA
9	SARANTIS SA
10	C.I. SARANTOPOULOS SA
11	SHELMAN
12	SELONTA AQUACULTURES SA
13	SIGALAS SA
14	SIDENOR STEEL PRODUCTS MANUFACTURING COMPANY SA
15	STRINTZIS LINES
16	TERNA SA
17	VOLOS TECHNICAL COMPANY
18	TECHNICAL OLYMPIC SA
19	PIPE WORKS GIRAKIAN PROFIL SA
20	TILETIPOS SA
21	TITAN CEMENT CO SA
22	BANK OF GREECE
23	THE PHOENIX GREEK GENERAL INSURANCE
24	FOURLIS SA
25	CHATZIIOANNOU HOLDINGS SA

CRITERION 2: DATE OF ENTRY IN THE ATHENS STOCK EXCHANGE

PORTFOLIO 1		
No	**FIRM**	**ENTRY DATE**
1	ALPHA BANK SA	1/1/85
2	FINTEXPORT	1/1/85
3	MULTIRAMA SA	1/1/85
4	STABILTON SA	1/1/85
5	ATHENIAN CAPITAL HOLDINGS SA	1/1/85
6	ALLATINI IND. & COM. CO	1/1/85
7	ALUMINIUM OF GREECE SA	1/1/85
8	ASPIS PRONOIA GENERAL INSURANCES SA	1/1/85
9	BIOSSOL SA	1/1/85
10	VIOTER SA	1/1/85
11	VIOHALCO	1/1/85
12	VIS CONTAINER MANUFACTORING CO	1/1/85
13	GENERAL HELLENIC BANK	1/1/85
14	N.B.G. REAL ESTATE DEVELOPMENT CO	1/1/85
15	ETHNIKI GREEK GENERAL INSURANCE COMPANY	1/1/85
16	NATIONAL BANK OF GREECE	1/1/85
17	ELAIS OLEAGINOUS PROD. SA	1/1/85
18	COMMERCIAL BANK OF GREECE	1/1/85
19	N.I.B.I.D.	1/1/85
20	ETMA RAYON	1/1/85
21	ZAMPA SA	1/1/85
22	IONIAN HOTEL ENTERPRISES SA	1/1/85
23	HIPPOTOUR SA	1/1/85
24	KARELIA TOBACCO COMPANY INC SA	1/1/85
25	KEKROPS HOTEL TOURIST. BUILD.	1/1/85

PORTFOLIO 2		
No	**FIRM**	**ENTRY DATE**
1	KERAMIA-ALLATINI	1/1/85
2	KLONATEX GROUP OF COMPANIES SA	1/1/85
3	LAPSA HOTEL CO	1/1/85
4	LANAKAM SA	1/1/85
5	LEVEDERIS SA	1/1/85
6	METKA SA	1/1/85
7	BALAFAS SA	1/1/85
8	PAPASTRATOS CIGARETTE	1/1/85
9	PAVLIDES CONFECTIONARY	1/1/85
10	BANK OF PIRAEUS SA	1/1/85
11	PETZETAKIS SA	1/1/85
12	RADIO ATHENAI SA	1/1/85
13	TITAN CEMENT CO SA	1/1/85
14	BANK OF GREECE	1/1/85
15	THE PHOENIX GREEK GENERAL INSURANCE	1/1/85
16	ALPHA LEASING SA	8/17/87
17	ELFICO SA	8/28/87
18	BOUTARIS & SON HOLDING SA	12/14/87
19	HERACLES GENERAL CEMENT COMPANY	12/31/87
20	SHELMAN	3/28/88
21	FOURLIS SA	4/21/88
22	NEXANS HELLAS SA	3/12/90
23	BITROS HOLDING SA	3/13/90
24	ALFA ALFA HOLDINGS SA	5/3/90
25	MICROMEDIA BRITANNIA SA	5/30/90

PORTFOLIO 3		
No	FIRM	ENTRY DATE
1	BENRUBI SA	6/5/90
2	LOULIS MILLS SA	6/6/90
3	HELLENIC EXCHANGES SA	6/14/90
4	SATO SA	6/15/90
5	INTRACOM SA	6/28/90
6	MICHANIKI SA	7/19/90
7	GENERAL COMMERCIAL & INDUSTRIAL SA	7/24/90
8	METAL INDUSTRY OF ARCADIA C. ROKAS SA	8/27/90
9	PIPE WORKS GIRAKIAN PROFIL SA	8/29/90
10	KALPINIS-SIMOS STEEL SERVICE CENTER	8/30/90
11	DELTA HOLDINGS SA	10/29/90
12	ALBIO HOLDINGS SA	11/12/90
13	KATSELIS SA BREAD INDUSTRY	11/19/90
14	APLHA-BETA VASSILOPOULOS SA	11/26/90
15	CYCLON HELLAS SA	12/17/90
16	ELMEC SPORT SA	2/28/91
17	MOUZAKIS SA	3/29/91
18	SELECTED TEXTILE INDUSTRIES ASSOCIATION	4/15/91
19	NIKAS SA	4/22/91
20	RILKEN SA	4/29/91
21	RIDENCO SA	5/28/91
22	UNCLE STATHIS SA	6/24/91
23	DARING S.A.I.N.	7/8/91
24	COCA-COLA HELLENIC BOTTLING COMPANY SA	7/15/91
25	EGNATIA BANK SA	7/17/91

PORTFOLIO 4		
No	FIRM	ENTRY DATE
1	ELTRAK SA	8/20/91
2	SANYO HELLAS HOLDING SA	8/27/91
3	ATHENS MEDICAL C.S.A.	8/29/91
4	CHATZIIOANNOU HOLDINGS SA	12/31/91
5	HELLAS CAN PACKAGING MANUFACTURERS SA	1/7/92
6	HELLENIC SUGAR INDUSTRY SA	8/30/93
7	AEGEK SA	11/29/93
8	THEMELIODOMI SA	12/13/93
9	PROODEFTIKI TECHNICAL COMPANY	12/16/93
10	AKTOR SA TECHNICAL COMPANY	12/29/93
11	FANCO SA	12/31/93
12	TERNA SA	1/20/94
13	VOLOS TECHNICAL COMPANY	2/3/94
14	TECHNICAL OLYMPIC SA	4/6/94
15	HELLENIC TECHNODOMIKI SA	4/20/94
16	DELTA SINGULAR SA	5/4/94
17	GNOMON CONSTRUCTION CO.	5/4/94
18	EUROPEAN TECHNICAL SA	6/6/94
19	ETEM SA LIGHT METALS INDUSTRY	6/9/94
20	NAOUSSA SPINNING MILLS SA	6/14/94
21	AXON SA HOLDING	6/15/94
22	MAILLIS SA	6/16/94
23	STRINTZIS LINES	6/17/94
24	ERGAS SA	6/23/94
25	SELONTA AQUACULTURES SA	6/24/94

PORTFOLIO 5		
No	FIRM	ENTRY DATE
1	CHIPITA INTERNATIONAL SA	6/30/94
2	SARANTIS SA	7/4/94
3	ATTIKAT SA	7/7/94
4	GENERAL CONSTRUCTION COMPANY	7/11/94
5	INFORM LYCOS	7/25/94
6	C.I. SARANTOPOULOS SA	8/3/94
7	MOCHLOS SA	8/8/94
8	MESOCHORITIS BROS	8/10/94
9	TILETIPOS SA	8/18/94
10	AVAX SA CONSTRUCTION CO	8/24/94
11	GEKAT CONSTRUCTION COMPANY	8/29/94
12	ELBISCO HOLDING SA	10/10/94
13	HELLENIC FABRICS SA	10/25/94
14	EDRASIS-PSALLIDAS SA	11/14/94
15	HELLENIC CABLES SA	11/16/94
16	EKTER SA	11/23/94
17	KRE.KA SA	12/5/94
18	INTRASOFT SA	12/7/94
19	DIEKAT SA	12/9/94
20	SIDENOR STEEL PRODUCTS MANUFACTURING COMPANY SA	12/12/94
21	SIGALAS SA	12/14/94
22	SILVER & BARYTE ORES MINING CO	12/16/94
23	GOODY'S SA	12/29/94
24	METROLIFE SA	12/30/94
25	ALTE TECHNICAL COMPANY	1/9/95

CRITERION 3: MARKET CAPITALIZATION

PORTFOLIO 1		
No	FIRM	MARKET CAPITALIZATION (in millions euros)
1	N.B.G. REAL ESTATE DEVELOPMENT	5,816.05
2	COCA-COLA HELLENIC BOTTLING COMPANY SA	3,715.70
3	ALPHA BANK SA	3,414.56
4	COMMERCIAL BANK OF GREECE	2575.52
5	VIOHALCO	1,590.73
6	TITAN CEMENT CO SA	1,534.89
7	BANK OF PIRAEUS SA	1,280.43
8	INTRACOM SA	1,106.53
9	HERACLES GENERAL CEMENT COMPANY	857.26
10	ALUMINIUM OF GREECE SA	798.39
11	BANK OF GREECE	746.87
12	HELLENIC TECHNODOMIKI SA	620.00
13	ETHNIKI GREEK GENERAL INSURANCE COMPANY	530.13
14	DELTA SINGULAR SA	489.16
15	AVAX SA CONSTRUCTION CO	479.46
16	THE PHOENIX GREEK GENERAL INSURANCE	447.20
17	AKTOR SA TECHNICAL COMPANY	427.90
18	HELLENIC EXCHANGES SA	416.69
19	PAPASTRATOS CIGARETTE CO	415.47
20	MAILLIS SA	405.63
21	SIDENOR STEEL PRODUCTS MANUFACTURING COMPANY SA	376.30
22	N.I.B.I.D.	372.40
23	CHIPITA INTERNATIONAL SA	328.42
24	EGNATIA BANK SA	316.88
25	ATHENS MEDICAL C.S.A.	312.43

PORTFOLIO 2		
No	FIRM	MARKET CAPITALIZATION (in millions euros)
1	INTRASOFT SA	311.95
2	NATIONAL BANK OF GREECE	289.77
3	AEGEK SA	289.15
4	GENERAL HELLENIC BANK	270.63
5	ALPHA LEASING SA	263.90
6	ELAIS OLEAGINOUS PROD. SA	229.94
7	HELLENIC SUGAR INDUSTRY SA	229.92
8	GOODY'S SA	229.88
9	METKA SA	229.62
10	SILVER & BARYTE ORES MINING CO	223.04
11	DELTA HOLDINGS SA	219.97
12	GENERAL CONSTRUCTION COMPANY	218.43
13	ALFA ALFA HOLDINGS SA	200.74
14	NAOUSSA SPINNING MILLS SA	189.89
15	INFORM LYCOS	166.17
16	STRINTZIS LINES	159.60
17	METAL INDUSTRY OF ARCADIA C. ROKAS	152.03
18	THEMELIODOMI SA	148.94
19	SANYO HELLAS HOLDING SA	147.68
20	TILETIPOS SA	142.44
21	ELBISCO HOLDING SA	142.08
22	KEKROPS HOTEL TOURIST. BUILD.	140.61
23	MICHANIKI SA	140.01
24	HELLAS CAN PACKAGING MANUFACTURERS SA	135.91
25	ALTE TECHNICAL COMPANY	135.60

PORTFOLIO 3		
No	FIRM	MARKET CAPITALIZATION (in millions euros)
1	KARELIA TOBACCO COMPANY INC SA	132.59
2	APLHA-BETA VASSILOPOULOS SA	121.84
3	ASPIS PRONOIA GENERAL INSURANCES SA	120.36
4	KLONATEX GROUP OF COMPANIES SA	119.60
5	HELLENIC FABRICS SA	115.29
6	SARANTIS SA	114.16
7	IONIAN HOTEL ENTERPRISES SA	113.94
8	CHATZIIOANNOU HOLDINGS SA	107.07
9	EDRASIS-PSALLIDAS SA	105.07
10	KERAMIA-ALLATINI	104.63
11	PETZETAKIS SA	104.23
12	TERNA SA	102.90
13	FOURLIS SA	101.28
14	ATTIKAT SA	100.89
15	ELMEC SPORT SA	96.40
16	HELLENIC CABLES SA	93.64
17	VOLOS TECHNICAL COMPANY	92.40
18	MOUZAKIS SA	91.16
19	METROLIFE SA	87.85
20	SHELMAN	87.50
21	SELECTED TEXTILE INDUSTRIES ASSOCIATION SA	86.46
22	VIOTER SA	85.60
23	ETEM SA LIGHT METALS INDUSTRY	85.23
24	BALAFAS SA	82.74
25	LAPSA HOTEL CO	79.96

PORTFOLIO 4		
No	FIRM	MARKET CAPITALIZATION (in millions euros)
1	AXON SA HOLDING	77.83
2	MOCHLOS SA	77.44
3	NIKAS SA	74.45
4	PROODEFTIKI TECHNICAL COMPANY	74.20
5	C.I. SARANTOPOULOS SA	73.08
6	CYCLON HELLAS SA	68.53
7	FANCO SA	65.33
8	DIEKAT SA	64.98
9	BOUTARIS & SON HOLDING SA	62.25
10	LOULIS MILLS SA	59.54
11	ALBIO HOLDINGS SA	57.60
12	ATHENIAN CAPITAL HOLDINGS SA	57.36
13	UNCLE STATHIS SA	56.98
14	KATSELIS SA BREAD INDUSTRY	56.70
15	DARING S.A.I.N.	56.21
16	BENRUBI SA	52.63
17	STABILTON SA	51.73
18	GNOMON CONSTRUCTION CO. SA	50.86
19	NEXANS HELLAS SA	50.41
20	BITROS HOLDING SA	50.14
21	EUROPEAN TECHNICAL SA	49.26
22	SELONTA AQUACULTURES SA	48.89
23	HIPPOTOUR SA	46.11
24	KRE.KA SA	44.89
25	GENERAL COMMERCIAL & INDUSTRIAL SA	44.03

PORTFOLIO 5		
No	FIRM	MARKET CAPITALIZATION (in millions euros)
1	RILKEN SA	43.48
2	PAVLIDES CONFECTIONARY SA	43.10
3	KALPINIS-SIMOS STEEL SERVICE CENTER	39.78
4	ZAMPA SA	39.21
5	TECHNICAL OLYMPIC SA	38.75
6	SATO SA	38.53
7	RIDENCO SA	38.28
8	ALLATINI IND. & COM. CO	34.75
9	GEKAT CONSTRUCTION COMPANY	34.52
10	ELTRAK SA	33.87
11	MICROMEDIA BRITANNIA SA	32.58
12	MESOCHORITIS BROS	29.70
13	RADIO ATHENAI SA	29.62
14	PIPE WORKS GIRAKIAN PROFIL SA	29.59
15	EKTER SA	27.18
16	SIGALAS SA	26.80
17	ETMA RAYON	24.57
18	ERGAS SA	23.34
19	MULTIRAMA SA	22.11
20	FINTEXPORT	20.95
21	VIS CONTAINER MANUFACTORING CO	20.44
22	ELFICO SA	19.41
23	BIOSSOL SA	17.58
24	LEVEDERIS SA	16.63
25	LANAKAM SA	15.90

CRITERION 4: PRICE-TO EARNINGS RATIO

PORTFOLIO 1		
No	**FIRM**	**P/E**
1	ALBIO HOLDINGS SA	100+
2	STABILTON SA	100+
3	ALLATINI IND. & COM. CO	100+
4	VIS CONTAINER MANUFACTORING CO	100+
5	SELECTED TEXTILE INDUSTRIES ASSOCIATION SA	100+
12	EUROPEAN TECHNICAL SA	100+
6	HIPPOTOUR SA	100+
7	KEKROPS HOTEL TOURIST. BUILD.	100+
8	KERAMIA-ALLATINI	100+
9	KLONATEX GROUP OF COMPANIES SA	100+
10	BITROS HOLDING SA	100+
11	BOUTARIS & SON HOLDING SA	100+
13	PETZETAKIS SA	94.5
14	EDRASIS-PSALLIDAS SA	90
15	CHATZIIOANNOU HOLDINGS SA	86
16	LEVEDERIS SA	81.5
17	CHIPITA INTERNATIONAL SA	77
18	GNOMON CONSTRUCTION CO. SA	72.7
19	MICROMEDIA BRITANNIA SA	70.8
20	GOODY'S SA	67.7
21	HERACLES GENERAL CEMENT COMPANY	65.7
22	VIOTER SA	61.5
23	ELBISCO HOLDING SA	60.9
24	GEKAT CONSTRUCTION COMPANY	53.2
25	INTRASOFT SA	50

PORTFOLIO 2		
No	**FIRM**	**P/E**
1	TECHNICAL OLYMPIC SA	49.7
2	PIPE WORKS GIRAKIAN PROFIL SA	49.5
3	IONIAN HOTEL ENTERPRISES SA	48.8
4	MESOCHORITIS BROS	47.4
5	LAPSA HOTEL CO	47
6	HELLENIC EXCHANGES SA	46
7	EKTER SA	45.5
8	COCA-COLA HELLENIC BOTTLING COMPANY SA	45.3
9	N.B.G. REAL ESTATE DEVELOPMENT CO	44.4
10	MAILLIS SA	43.8
11	MOCHLOS SA	43.5
12	ALFA ALFA HOLDINGS SA	42.2
13	MOUZAKIS SA	41.5
14	MICHANIKI SA	40.5
15	AVAX SA CONSTRUCTION CO	39.4
16	KRE.KA SA	39.2
17	VOLOS TECHNICAL COMPANY	39
18	ETHNIKI GREEK GENERAL INSURANCE COMPANY	38.6
19	ZAMPA SA	37.4
20	SARANTIS SA	37.2
21	GENERAL HELLENIC BANK	36.3
22	DIEKAT SA	36
23	VIOHALCO	34.5
24	METKA SA	34.4
25	GENERAL COMMERCIAL & INDUSTRIAL SA	34.3

PORTFOLIO 3		
No	FIRM	P/E
1	KATSELIS SA BREAD INDUSTRY	33.8
2	SIGALAS SA	31.8
3	BENRUBI SA	30.9
4	METAL INDUSTRY OF ARCADIA C. ROKAS SA	30.9
5	HELLAS CAN PACKAGING MANUFACTURERS SA	29.6
6	THEMELIODOMI SA	29.4
7	FINTEXPORT	29.2
8	LANAKAM SA	28
9	NIKAS SA	27.5
10	HELLENIC FABRICS SA	27.1
11	BANK OF GREECE	27.1
12	TERNA SA	26.8
13	PAVLIDES CONFECTIONARY SA	26.3
14	METROLIFE SA	26
15	DELTA SINGULAR SA	25.9
16	PROODEFTIKI TECHNICAL COMPANY	25.5
17	TILETIPOS SA	24.6
18	TITAN CEMENT CO SA	24.5
19	AKTOR SA TECHNICAL COMPANY	23.9
20	SIDENOR STEEL PRODUCTS MANUFACTURING COMPANY SA	23.5
21	C.I. SARANTOPOULOS SA	23.4
22	LOULIS MILLS SA	23.1
23	SANYO HELLAS HOLDING SA	22.2
24	GENERAL CONSTRUCTION COMPANY	21.5
25	ASPIS PRONOIA GENERAL INSURANCES SA	21.3

PORTFOLIO 4		
No	FIRM	P/E
1	APLHA-BETA VASSILOPOULOS SA	21.2
2	HELLENIC CABLES SA	21.1
3	SATO SA	20.9
4	ATHENS MEDICAL C.S.A.	20.9
5	AEGEK SA	20.5
6	UNCLE STATHIS SA	20.4
7	HELLENIC SUGAR INDUSTRY SA	19.4
8	PAPASTRATOS CIGARETTE CO	19.4
9	INFORM LYCOS	17.9
10	HELLENIC TECHNODOMIKI SA	16.9
11	ELAIS OLEAGINOUS PROD. SA	16.8
12	ETEM SA LIGHT METALS INDUSTRY	16.6
13	ELTRAK SA	16.5
14	ATTIKAT SA	16.4
15	SHELMAN	15.5
16	SELONTA AQUACULTURES SA	15.1
17	ALUMINIUM OF GREECE SA	14.9
18	KALPINIS-SIMOS STEEL SERVICE CENTER	14.9
19	RIDENCO SA	14.6
20	NEXANS HELLAS SA	14.2
21	ALPHA BANK SA	14
22	DARING S.A.I.N.	14
23	THE PHOENIX GREEK GENERAL INSURANCE	13.1
24	ALPHA LEASING SA	13
25	EGNATIA BANK SA	13

PORTFOLIO 5		
No	FIRM	P/E
1	SILVER & BARYTE ORES MINING CO	12.7
2	KARELIA TOBACCO COMPANY INC SA	12.7
3	ELMEC SPORT SA	12.2
4	COMMERCIAL BANK OF GREECE	12.1
5	RADIO ATHENAI SA	12
6	RILKEN SA	11.8
7	ERGAS SA	11.2
8	ELFICO SA	11.1
9	MULTIRAMA SA	10
10	FOURLIS SA	10
11	AXON SA HOLDING	8.8
12	NATIONAL BANK OF GREECE	8.5
13	INTRACOM SA	8.4
14	NAOUSSA SPINNING MILLS SA	8.3
15	DELTA HOLDINGS SA	8.2
16	BANK OF PIRAEUS SA	8
17	N.I.B.I.D.	7.9
18	ALTE TECHNICAL COMPANY	7.3
19	BALAFAS SA	5.2
20	FANCO SA	-
21	ATHENIAN CAPITAL HOLDINGS SA	-
22	BIOSSOL SA	-
23	ETMA RAYON	-
24	CYCLON HELLAS SA	-
25	STRINTZIS LINES	-

CRITERION 5: MARKET BETAS

PORTFOLIO 1		
No	**FIRM**	**MARKET BETA**
1	ATHENIAN CAPITAL HOLDINGS SA	3.340
2	MICROMEDIA BRITANNIA SA	2.266
3	VIS CONTAINER MANUFACTORING CO	2.259
4	EKTER SA	2.175
5	EUROPEAN TECHNICAL SA	2.158
6	SIGALAS SA	2.139
7	MESOCHORITIS BROS	2.087
8	DARING S.A.I.N.	2.047
9	GENERAL COMMERCIAL & INDUSTRIAL SA	2.024
10	SANYO HELLAS HOLDING SA	2.000
11	ERGAS SA	1.986
12	ATTIKAT SA	1.957
13	GNOMON CONSTRUCTION CO. SA	1.955
14	MOCHLOS SA	1.943
15	GEKAT CONSTRUCTION COMPANY	1.903
16	SATO SA	1.890
17	TERNA SA	1.877
18	LEVEDERIS SA	1.875
19	N.B.G. REAL ESTATE DEVELOPMENT CO	1.850
20	KLONATEX GROUP OF COMPANIES SA	1.822
21	BIOSSOL SA	1.820
22	ELTRAK SA	1.815
23	MICHANIKI SA	1.802
24	LANAKAM SA	1.800
25	ETMA RAYON	1.788

PORTFOLIO 2		
No	**FIRM**	**MARKET BETA**
1	PROODEFTIKI TECHNICAL COMPANY	1.788
2	VIOTER SA	1.787
3	FINTEXPORT	1.768
4	NAOUSSA SPINNING MILLS SA	1.765
5	GENERAL CONSTRUCTION COMPANY	1.731
6	VOLOS TECHNICAL COMPANY	1.728
7	ELFICO SA	1.693
8	FOURLIS SA	1.669
9	AXON SA HOLDING	1.660
10	KRE.KA SA	1.654
11	NIKAS SA	1.640
12	DIEKAT SA	1.638
13	MULTIRAMA SA	1.626
14	METAL INDUSTRY OF ARCADIA C. ROKAS	1.625
15	BENRUBI SA	1.615
16	AEGEK SA	1.604
17	ALTE TECHNICAL COMPANY	1.579
18	BITROS HOLDING SA	1.574
19	BOUTARIS & SON HOLDING SA	1.555
20	METROLIFE SA	1.551
21	STABILTON SA	1.546
22	LAPSA HOTEL CO	1.541
23	PIPE WORKS GIRAKIAN PROFIL SA	1.531
24	RIDENCO SA	1.527
25	TECHNICAL OLYMPIC SA	1.507

PORTFOLIO 3		
No	FIRM	MARKET BETA
1	DELTA SINGULAR SA	1.498
2	ALFA ALFA HOLDINGS SA	1.492
3	ATHENS MEDICAL C.S.A.	1.464
4	ELMEC SPORT SA	1.460
5	MOUZAKIS SA	1.449
6	HELLENIC TECHNODOMIKI SA	1.442
7	ALLATINI IND. & COM. CO	1.420
8	AKTOR SA TECHNICAL COMPANY	1.419
9	KEKROPS HOTEL TOURIST. BUILD.	1.418
10	RADIO ATHENAI SA	1.414
11	INFORM LYCOS	1.396
12	C.I. SARANTOPOULOS SA	1.386
13	ETHNIKI GREEK GENERAL INSURANCE COMPANY	1.376
14	SHELMAN	1.366
15	FANCO SA	1.365
16	ELBISCO HOLDING SA	1.360
17	ZAMPA SA	1.355
18	KALPINIS-SIMOS STEEL SERVICE CENTER	1.355
19	SELECTED TEXTILE INDUSTRIES ASSOCIATION SA	1.353
20	INTRASOFT SA	1.346
21	SELONTA AQUACULTURES SA	1.341
22	SARANTIS SA	1.332
23	HELLENIC FABRICS SA	1.331
24	BALAFAS SA	1.327
25	KERAMIA-ALLATINI	1.313

PORTFOLIO 4		
No	FIRM	MARKET BETA
1	NEXANS HELLAS SA	1.304
2	EDRASIS-PSALLIDAS SA	1.300
3	HELLENIC SUGAR INDUSTRY SA	1.290
4	CHATZIIOANNOU HOLDINGS SA	1.280
5	THEMELIODOMI SA	1.237
6	INTRACOM SA	1.194
7	HIPPOTOUR SA	1.187
8	STRINTZIS LINES	1.187
9	TILETIPOS SA	1.177
10	HELLENIC EXCHANGES SA	1.170
11	GENERAL HELLENIC BANK	1.160
12	CYCLON HELLAS SA	1.147
13	IONIAN HOTEL ENTERPRISES SA	1.131
14	NATIONAL BANK OF GREECE	1.123
15	ALBIO HOLDINGS SA	1.116
16	LOULIS MILLS SA	1.105
17	METKA SA	1.087
18	N.I.B.I.D.	1.086
19	COMMERCIAL BANK OF GREECE	1.085
20	BANK OF GREECE	1.048
21	ETEM SA LIGHT METALS INDUSTRY	1.045
22	MAILLIS SA	1.040
23	BANK OF PIRAEUS SA	1.036
24	DELTA HOLDINGS SA	1.021
25	SIDENOR STEEL PRODUCTS MANUFACTURING COMPANY SA	1.018

PORTFOLIO 5		
No	FIRM	MARKET BETA
1	VIOHALCO	1.011
2	ALPHA BANK SA	1.006
3	HELLAS CAN PACKAGING MANUFACTURERS SA	0.967
4	ALPHA LEASING SA	0.951
5	AVAX SA CONSTRUCTION CO	0.940
6	KATSELIS SA BREAD INDUSTRY	0.935
7	EGNATIA BANK SA	0.925
8	ALUMINIUM OF GREECE SA	0.918
9	SILVER & BARYTE ORES MINING CO	0.900
10	PAVLIDES CONFECTIONARY SA	0.891
11	PETZETAKIS SA	0.877
12	APLHA-BETA VASSILOPOULOS SA	0.847
13	KARELIA TOBACCO COMPANY INC SA	0.828
14	PAPASTRATOS CIGARETTE CO	0.776
15	HELLENIC CABLES SA	0.737
16	HERACLES GENERAL CEMENT COMPANY	0.711
17	UNCLE STATHIS SA	0.672
18	GOODY'S SA	0.654
19	ELAIS OLEAGINOUS PROD. SA	0.634
20	CHIPITA INTERNATIONAL SA	0.628
21	THE PHOENIX GREEK GENERAL INSURANCE	0.626
22	TITAN CEMENT CO SA	0.582
23	COCA-COLA HELLENIC BOTTLING COMPANY SA	0.580
24	RILKEN SA	0.478
25	ASPIS PRONOIA GENERAL INSURANCES SA	0.469

CRITERION 6: SECTOR CHARACTERISTICS

	PORTFOLIO 1: INDUSTRY
No	**FIRM**
1	HELLAS CAN PACKAGING MANUFACTURERS
2	NEXANS HELLAS SA
3	RILKEN SA
4	ALUMINIUM OF GREECE SA
5	SILVER & BARYTE ORES MINING CO
6	BIOSSOL SA
7	VIS CONTAINER MANUFACTORING CO
8	DARING S.A.I.N.
9	HELLENIC CABLES SA
10	ETEM SA LIGHT METALS INDUSTRY
11	ETMA RAYON
12	HERACLES GENERAL CEMENT COMPANY
13	KARELIA TOBACCO COMPANY INC SA
14	KERAMIA-ALLATINI
15	LEVEDERIS SA
16	MAILLIS SA
17	METKA SA
18	PAPASTRATOS CIGARETTE CO
19	PETZETAKIS SA
20	CYCLON HELLAS SA
21	METAL INDUSTRY OF ARCADIA C. ROKAS
22	SHELMAN
23	SIDENOR STEEL PRODUCTS MANUFACTURING
24	PIPE WORKS GIRAKIAN PROFIL SA
25	TITAN CEMENT CO SA
26	FLEXOPACK SA PLASTICS
27	ALCO HELLAS SA
28	ELVAL HELLENIC ALUMINIUM INDUSTRY
29	HELLATEX SA SYNTHETIC YARNS
30	ESHA SA
31	PAIRIS SA
32	SFAKIANAKIS SA
33	HALCOR SA METAL WORKS

	PORTFOLIO 3: CONSTRUCTION
No	**FIRM**
1	AVAX SA CONSTRUCTION CO
2	AEGEK SA
3	AKTOR SA TECHNICAL COMPANY
4	ALTE TECHNICAL COMPANY
5	ATTIKAT SA
6	VIOTER SA
7	GENERAL CONSTRUCTION COMPANY
8	GEKAT CONSTRUCTION COMPANY
9	GNOMON CONSTRUCTION CO. SA
10	DIEKAT SA
11	EDRASIS-PSALLIDAS SA
12	EKTER SA
13	HELLENIC TECHNODOMIKI SA
14	ERGAS SA
15	EUROPEAN TECHNICAL SA
16	THEMELIODOMI SA
17	MESOCHORITIS BROS
18	MICHANIKI SA
19	MOCHLOS SA
20	PROODEFTIKI TECHNICAL COMPANY
21	C.I. SARANTOPOULOS SA
22	SIGALAS SA
23	TERNA SA
24	VOLOS TECHNICAL COMPANY
25	TECHNICAL OLYMPIC SA
26	ATHENA HELL. ENG. IND. & TOUR. CO
27	ATEMKE SA
28	GENER SA
29	EFKLEIDIS SA

	PORTFOLIO 2: TECHNOLOGY
No	**FIRM**
1	INFORM LYCOS
2	INTRACOM SA
3	DELTA SINGULAR SA
4	TILETIPOS SA
5	ALTEC CA
6	INTERTECH SA
7	HELLENIC TELECOM. ORGANIZATION CO
8	POULIADIS ASSOCIATES CORPORATION

	PORTFOLIO 4: TEXTILES
No	**FIRM**
1	FINTEXPORT
2	HELLENIC FABRICS SA
3	ELFICO SA
4	SELECTED TEXTILE INDUSTRIES ASSOCIATION
5	NAOUSSA SPINNING MILLS SA
6	LANAKAM SA
7	MOUZAKIS SA
8	TEXTILE IND NAFPAKTOS
9	KNITWEAR FACTORY MAXIM PERTSINIDIS
10	THRACE PLASTICS Co SA

PORTFOLIO 5: COMMERCE	
No	FIRM
1	ELMEC SPORT SA
2	MICROMEDIA BRITANNIA SA
3	MULTIRAMA SA
4	RIDENCO SA
5	APLHA-BETA VASSILOPOULOS SA
6	ALLATINI IND. & COM. CO
7	GENERAL COMMERCIAL & INDUSTRIAL SA
8	ELTRAK SA
9	ZAMPA SA
10	KALPINIS-SIMOS STEEL SERVICE CENTER
11	BENRUBI SA
12	RADIO ATHENAI SA
13	SARANTIS SA
14	JUMBO SA
15	LAVIPHARM SA
16	YALCO-CONSTANTINOU SA
17	THE HOUSE OF AGRICULTURE SPIROU SA
18	CARDASSILARIS - CARDICO SA
19	MYTILINEOS HOLDINGS SA
20	RADIO KORASIDIS COMMERCIAL
21	TASOGLOU SA - DELONGHI

PORTFOLIO 7: CONSUMPTION	
No	FIRM
1	CHIPITA INTERNATIONAL SA
2	COCA-COLA HELLENIC BOTTLING COMPANY
3	FANCO SA
4	GOODY'S SA
5	SATO SA
6	HELLENIC SUGAR INDUSTRY SA
7	ELAIS OLEAGINOUS PROD. SA
8	KATSELIS SA BREAD INDUSTRY
9	KRE.KA SA
10	LOULIS MILLS SA
11	UNCLE STATHIS SA
12	NIKAS SA
13	PAVLIDES CONFECTIONARY SA
14	SELONTA AQUACULTURES SA
15	ELVE SA
16	NIREFS SA
17	ELBISCO HOLDING SA
18	CHATZIIOANNOU HOLDINGS SA
19	BOUTARIS & SON HOLDING SA

PORTFOLIO 6: FINANCE	
No	FIRM
1	ALPHA BANK SA
2	ALPHA LEASING SA
3	METROLIFE SA
4	ASPIS PRONOIA GENERAL INSURANCES
5	GENERAL HELLENIC BANK
6	EGNATIA BANK SA
7	N.B.G. REAL ESTATE DEVELOPMENT CO
8	ETHNIKI GREEK GENERAL INSURANCE CO
9	NATIONAL BANK OF GREECE
10	COMMERCIAL BANK OF GREECE
11	N.I.B.I.D.
12	IONIAN HOTEL ENTERPRISES SA
13	KEKROPS HOTEL TOURIST. BUILD.
14	BANK OF PIRAEUS SA
15	BANK OF GREECE
16	THE PHOENIX GREEK GENERAL INSURANCE
17	EUROPEAN RELIANCE GEN. INS. SA
18	PIRAEUS LEASING

APPENDIX C: FIRMS' SENSITIVITIES TO RISK FACTORS

NO	FIRM	DEF	INF	RET	RM	TS
1	**ALBIO HOLDINGS SA**	**-0,110**	**0,096**	**-1,999**	**0,687**	**-0,426**
		(-0,227)	(0,395)	(-1,876)	(3,388)	(-1,236)
2	**ALFA ALFA HOLDINGS SA**	**0,051**	**0,095**	**-2,812**	**1,009**	**-0,600**
		(0,106)	(0,390)	(-2,640)	(4,972)	(-1,739)
3	**ALPHA BANK SA**	**-0,197**	**0,238**	**-1,414**	**1,015**	**-0,034**
		(-0,809)	(1,948)	(-2,636)	(9,939)	(-0,195)
4	**ALPHA LEASING SA**	**0,455**	**0,136**	**-1,024**	**0,769**	**-0,357**
		(1,184)	(0,708)	(-1,214)	(4,7890	(-1,307)
5	**AXON SA HOLDING**	**0,017**	**-0,107**	**-2,761**	**0,713**	**-0,909**
		(0,030)	(-0,390)	(-2,283)	(3,096)	(-2,320)
6	**CHIPITA INTERNATIONAL SA**	**0,266**	**-0,053**	**-0,456**	**0,466**	**-0,256**
		(0,966)	(-0,386)	(-0,755)	(4,0520	(-1,3080
7	**COCA-COLA HELLENIC BOTTLING COMPANY SA**	**-0,019**	**-0,006**	**0,794**	**0,898**	**-0,235**
		(-0,066)	(-0,040)	(1,247)	(7,410)	(-1,141)
8	**ELBISCO HOLDING SA**	**-0,140**	**-0,589**	**-2,415**	**0,672**	**-0,442**
		(-0,235)	(-1,973)	(-1,839)	(2,688)	(-1,040)
9	**ELMEC SPORT SA**	**-0,044**	**0,103**	**-0,991**	**0,790**	**-0,264**
		(-0,065)	(0,306)	(-0,670)	(2,807)	(-0,550)
10	**FANCO SA**	**-0,632**	**-0,621**	**-2,404**	**0,739**	**-0,350**
		(-0,841)	(-1,654)	(-1,455)	(2,349)	(-0,655)
11	**FINTEXPORT**	**-1,488**	**-0,187**	**0,123**	**1,541**	**-0,372**
		(-2,321)	(-0,582)	(0,087)	(5,739)	(-0,815)
12	**GOODY'S SA**	**-0,242**	**0,138**	**-1,788**	**0,700**	**-0,196**
		(-0,780)	(0,889)	(-2,625)	(5,398)	(-0,886)
13	**HELLAS CAN PACKAGING MANUFACTURERS SA**	**0,315**	**-0,398**	**-1,354**	**0,783**	**-0,157**
		(1,076)	(-2,724)	(-2,106)	(6,391)	(-0,753)
14	**INFORM LYCOS**	**-0,659**	**-0,078**	**-1,911**	**0,647**	**-0,629**
		(-1,605)	(-0,381)	(-2,118)	(3,765)	(-2,152)
15	**INTRACOM SA**	**-0,188**	**0,076**	**-1,698**	**0,814**	**-0,494**
		(-0,518)	(0,421)	(-2,134)	(5,371)	(-1,917)
16	**METROLIFE SA**	**-0,582**	**-0,183**	**-2,124**	**0,778**	**-0,704**
		(-1,412)	(-0,888)	(-2,346)	(4,512)	(-2,401)
17	**MICROMEDIA BRITANNIA SA**	**-2,344**	**-0,353**	**-2,292**	**1,039**	**-1,068**
		(-3,625)	(-1,092)	(-1,612)	(3,836)	(-2,320)
18	**MULTIRAMA SA**	**-0,023**	**-0,476**	**0,964**	**0,442**	**-1,054**
		(-0,026)	(-1,103)	(0,508)	(1,223)	(-1,716)
19	**NEXANS HELLAS SA**	**0,202**	**0,054**	**-2,499**	**1,010**	**-0,220**
		(0,439)	(0,235)	(-2,472)	(5,245)	(-0,672)
20	**RIDENCO SA**	**-1,302**	**-0,093**	**-2,167**	**0,992**	**-0,291**
		(-1,939)	(-0,277)	(-1,468)	(3,530)	(-0,608)
21	**RILKEN SA**	**0,285**	**0,138**	**-1,037**	**0,744**	**-0,737**
		(0,503)	(0,488)	(-0,830)	(3,129)	(-1,823)
22	**SATO SA**	**0,311**	**-0,336**	**-2,100**	**1,147**	**-0,452**
		(0,457)	(-0,988)	(-1,406)	(4,035)	(-0,935)
23	**DELTA SINGULAR SA**	**-0,463**	**0,224**	**-2,733**	**1,089**	**-1,222**
		(-0,813)	(0,786)	(-2,183)	(4,567)	(-3,013)
24	**APLHA-BETA VASSILOPOULOS SA**	**0,045**	**-0,079**	**-1,727**	**0,566**	**-0,807**
		(0,144)	(-0,502)	(-2,504)	(4,310)	(-3,614)

Note: t-statistics in parenthesis-DEF= default risk INF= inflation rate, RET= real retail sales
TS= term structure

NO	FIRM	DEF	INF	RET	RM	TS
25	**AVAX SA CONSTRUCTION CO**	**-0,395**	**-0,258**	**-0,633**	**0,875**	**0,057**
		(-0,621)	(-0,812)	(-0,452)	(3,283)	(0,125)
26	**AEGEK SA**	**-0,269**	**-0,540**	**-1,344**	**1,185**	**-0,446**
		(-0,576)	(-2,319)	(-1,312)	(6,072)	(-1,344)
27	**AKTOR SA TECHNICAL COMPANY**	**-0,042**	**-0,403**	**-1,385**	**1,086**	**-0,232**
		(-0,101)	(-1,935)	(-1,512)	(6,228)	(-0,783)
28	**ALLATINI IND. & COM. CO**	**-0,126**	**-0,062**	**-0,919**	**0,992**	**-0,647**
		(-0,232)	(-0,230)	(-0,773)	(4,381)	(-1,680)
29	**ALUMINIUM OF GREECE SA**	**0,209**	**0,112**	**-1,398**	**0,950**	**0,071**
		(0,584)	(0,628)	(-1,776)	(6,335)	(0,279)
30	**ALTE TECHNICAL COMPANY**	**-0,462**	**-0,183**	**-2,811**	**1,188**	**-0,489**
		(-1,115)	(-0,885)	(-3,087)	(6,853)	(-1,659)
31	**SILVER & BARYTE ORES MINING CO**	**0,337**	**0,286**	**-0,960**	**0,796**	**-0,133**
		(1,086)	(1,845)	(-1,409)	(6,134)	(-0,601)
32	**ASPIS PRONOIA GENERAL INSURANCES SA**	**0,041**	**-0,195**	**-0,468**	**0,317**	**-0,377**
		(0,134)	(-1,265)	(-0,690)	(2,448)	(-1,713)
33	**ATTIKAT SA**	**-0,571**	**-0,391**	**-0,993**	**1,306**	**-0,145**
		(-0,851)	(-1,164)	(-0,673)	(4,646)	(-0,304)
34	**BIOSSOL SA**	**-0,217**	**-0,342**	**-0,274**	**0,824**	**-1,209**
		(-0,283)	(-0,890)	(-0,162)	(2,564)	(-2,211)
35	**VIOTER SA**	**-0,662**	**-0,368**	**-3,897**	**0,899**	**-0,423**
		(-1,130)	(-1,258)	(-3,025)	(3,663)	(-1,015)
36	**VIOHALCO**	**0,417**	**0,208**	**-2,302**	**0,861**	**-0,194**
		(1,196)	(1,195)	(-3,001)	(5,894)	(-0,781)
37	**VIS CONTAINER MANUFACTORING CO**	**-0,522**	**-0,268**	**-3,782**	**0,960**	**-0,661**
		(-0,701)	(-0,721)	(-2,313)	(3,083)	(-1,249)
38	**GENERAL COMMERCIAL & INDUSTRIAL SA**	**-1,447**	**-0,185**	**-2,461**	**0,840**	**-0,898**
		(-2,050)	(-0,523)	(-1,587)	(2,843)	(-1,787)
39	**GENERAL CONSTRUCTION COMPANY**	**-1,332**	**-0,343**	**-1,008**	**1,097**	**-0,484**
		(-2,630)	(-1,357)	(-0,905)	(5,173)	(-1,341)
40	**GEKAT CONSTRUCTION COMPANY**	**-0,815**	**-0,728**	**-2,910**	**0,633**	**-0,639**
		(-1,447)	(-2,586)	(-2,350)	(2,683)	(-1,594)
41	**GENERAL HELLENIC BANK**	**0,016**	**-0,019**	**-1,061**	**0,950**	**-0,537**
		(0,040)	(-0,091)	(-1,165)	(5,479)	(-1,822)
42	**GNOMON CONSTRUCTION CO. SA**	**-0,989**	**-0,523**	**-3,019**	**1,083**	**-0,187**
		(-1,830)	(-1,935)	(-2,541)	(4,787)	(-0,487)
43	**DARING S.A.I.N.**	**-0,491**	**-0,330**	**-1,309**	**1,408**	**-0,634**
		(-0,643)	(-0,864)	(-0,780)	(4,405)	(-1,167)
44	**DELTA HOLDINGS SA**	**0,083**	**0,102**	**-0,032**	**0,960**	**-0,297**
		(0,251)	(0,618)	(-0,044)	(6,959)	(-1,267)
45	**DIEKAT SA**	**-0,333**	**-0,504**	**-3,308**	**0,949**	**-0,823**
		(-0,528)	(-1,599)	(-2,389)	(3,600)	(-1,834)
46	**HELLENIC SUGAR INDUSTRY SA**	**0,646**	**0,519**	**-1,866**	**1,265**	**-0,635**
		(1,502)	(2,414)	(-1,974)	(7,028)	(-2,072)
47	**EGNATIA BANK SA**	**-0,216**	**-0,132**	**-2,022**	**0,866**	**-0,541**
		(-0,698)	(-0,853)	(-2,976)	(6,697)	(-2,460)
48	**EDRASIS-PSALLIDAS SA**	**-0,675**	**-0,404**	**-2,839**	**0,888**	**-0,354**
		(-1,683)	(-2,015)	(-3,219)	(5,289)	(-1,239)

Note: t-statistics in parenthesis-DEF= default risk INF=inflation rate, RET= real retail sales, TS= term structure

NO	FIRM	DEF	INF	RET	RM	TS
49	N.B.G. REAL ESTATE DEVELOPMENT	**0,502**	**0,155**	**-4,618**	**0,519**	**-1,260**
		(0,654)	(0,405)	(-2,736)	(1,616)	(-2,306)
50	ETHNIKI GREEK GENERAL INSURANCE CO	**-0,128**	**0,021**	**-1,894**	**1,176**	**-0,583**
		(-0,349)	(0,116)	(-2,352)	(7,670)	(-2,234)
51	NATIONAL BANK OF GREECE	**-0,533**	**0,338**	**-1,647**	**1,194**	**-0,187**
		(-2,090)	(2,650)	(-2,938)	(1,119)	(-1,032)
52	EKTER SA	**-1,033**	**-0,761**	**-3,475**	**1,091**	**-0,545**
		(-1,351)	(-1,990)	(-2,068)	(3,407)	(-1,002)
53	ELAIS OLEAGINOUS PROD. SA	**0,201**	**-0,154**	**-1,195**	**0,629**	**-0,085**
		(0,588)	(-0,902)	(-1,588)	(4,392)	(-0,348)
54	HELLENIC CABLES SA	**0,316**	**-0,203**	**-1,788**	**0,745**	**-0,299**
		(0,845)	(-1,086)	(-2,177)	(4,764)	(-1,125)
55	HELLENIC FABRICS SA	**-0,150**	**-0,181**	**1,171**	**0,839**	**-0,672**
		(-0,217)	(-0,526)	(0,775)	(2,915)	(-1,373)
56	HELLENIC TECHNODOMIKI SA	**0,081**	**-0,411**	**-1,305**	**1,122**	**-0,357**
		(0,170)	(-1,735)	(-1,253)	(5,656)	(-1,058)
57	ELTRAK SA	**-0,764**	**-0,611**	**-1,457**	**0,972**	**-0,331**
		(-1,323)	(-2,117)	(-1,148)	(4,018)	(-0,804)
58	ELFICO SA	**-0,588**	**-0,358**	**-0,787**	**0,485**	**-1,618**
		(-0,705)	(-0,858)	(-0,429)	(1,388)	(-2,725)
59	COMMERCIAL BANK OF GREECE	**-0,122**	**0,052**	**-2,199**	**1,025**	**-0,173**
		(-0,394)	(0,337)	(-3,244)	(7,942)	(-0,786)
60	SELECTED TEXTILE INDUSTRIES ASSOCIATION	**0,284**	**-0,035**	**-1,966**	**0,937**	**-0,844**
		(0,559)	(-0,138)	(-1,758)	(4,400)	(-2,332)
61	HELLENIC EXCHANGES SA	**0,129**	**0,001**	**-2,186**	**0,666**	**-0,167**
		(0,384)	(0,006)	(-2,948)	(4,719)	(-0,694)
62	ERGAS SA	**-0,254**	**-0,424**	**-2,744**	**1,247**	**-0,316**
		(-0,391)	(-1,307)	(-1,924)	(4,592)	(-0,683)
63	N.I.B.I.D.	**0,177**	**0,098**	**-0,565**	**0,849**	**0,074**
		(0,390)	(0,434)	(-0,567)	(4,472)	(0,229)
64	ETEM SA LIGHT METALS INDUSTRY	**0,176**	**-0,087**	**-2,691**	**0,737**	**-0,226**
		(0,411)	(-0,408)	(-2,857)	(4,111)	(-0,741)
65	ETMA RAYON	**-0,596**	**-0,246**	**-2,446**	**0,910**	**-1,220**
		(-0,748)	(-0,617)	(-1,396)	(2,7280	(-2,150)
66	EUROPEAN TECHNICAL SA	**-0,880**	**-0,167**	**-4,353**	**1,243**	**-0,261**
		(-1,167)	(-0,443)	(-2,626)	(3,9390	(-0,487)
67	ZAMPA SA	**-0,003**	**0,043**	**0,149**	**0,494**	**-0,283**
		(-0,005)	(0,123)	(0,097)	(1,701)	(-0,572)
68	HERACLES GENERAL CEMENT CO.	**0,247**	**-0,116**	**-1,301**	**0,777**	**-0,296**
		(0,892)	(-0,842)	(-2,139)	(6,708)	(-1,503)
69	THEMELIODOMI SA	**0,087**	**-0,110**	**-1,700**	**0,860**	**-0,170**
		(0,200)	(-0,502)	(-1,767)	(4,695)	(-0,545)
70	ATHENS MEDICAL C.S.A.	**-0,242**	**0,162**	**-3,451**	**0,786**	**-0,377**
		(-0,568)	(0,759)	(-3,682)	(4,401)	(-1,242)
71	IONIAN HOTEL ENTERPRISES SA	**-0,497**	**-0,199**	**-2,494**	**0,661**	**-0,877**
		(-1,016)	(-0,813)	(-2,321)	(3,229)	(-2,519)
72	HIPPOTOUR SA	**0,308**	**-0,325**	**-2,160**	**0,780**	**-1,081**
		(0,587)	(-1,240)	(-1,876)	93,558)	(-2,900)

Note: t-statistics in parenthesis-DEF= default risk INF= inflation rate, RET= real retail sales
TS= term structure

NO	FIRM	DEF	INF	RET	RM	TS
73	**KALPINIS-SIMOS STEEL SERVICE CENTER**	**-0,115**	**-0,291**	**-3,018**	**0,522**	**-0,896**
		(-0,204)	(-1,037)	(-2,444)	(2,220)	(-2,240)
74	**KARELIA TOBACCO COMPANY INC**	**0,311**	**-0,215**	**-0,376**	**0,696**	**-0,371**
		(0,790)	(-1,093)	(-0,434)	(4,221)	(-1,324)
75	**KATSELIS SA BREAD INDUSTRY**	**0,127**	**-0,147**	**-0,898**	**0,934**	**-0,679**
		(0,257)	(-0,596)	(-0,828)	(4,523)	(-1,934)
76	**KEKROPS HOTEL TOURIST. BUILD.**	**0,060**	**-0,076**	**-0,265**	**0,725**	**-0,189**
		(0,060)	(-0,152)	(-0,120)	(1,727)	(-0,265)
77	**KERAMIA-ALLATINI**	**0,125**	**-0,042**	**0,356**	**0,843**	**-0,747**
		(0,176)	(-0,119)	(0,229)	(2,842)	(-1,479)
78	**KLONATEX GROUP OF COMPANIES**	**-1,511**	**0,273**	**-3,277**	**0,907**	**-0,804**
		(-1,751)	(0,634)	(-1,729)	(2,513)	(-1,309)
79	**NAOUSSA SPINNING MILLS SA**	**-1,872**	**0,228**	**-3,445**	**0,977**	**-0,542**
		(-2,294)	(0,558)	(-1,920)	(2,861)	(-0,933)
80	**KRE.KA SA**	**0,284**	**-0,075**	**-1,955**	**0,939**	**-0,090**
		(0,456)	(-0,241)	(-1,429)	(3,604)	(-0,203)
81	**LAPSA HOTEL CO**	**-0,245**	**-0,400**	**-2,738**	**0,956**	**-0,457**
		(-0,351)	(-1,149)	(-1,787)	(3,275)	(-0,921)
82	**LANAKAM SA**	**-0,018**	**-0,032**	**-1,061**	**0,957**	**-0,490**
		(-0,025)	-0,092)	(-0,683)	(3,235)	(-0,974)
83	**LEVEDERIS SA**	**-1,279**	**-0,501**	**-2,248**	**0,787**	**-0,714**
		(-2,040)	(-1,600)	(-1,631)	(2,998)	(-1,600)
84	**LOULIS MILLS SA**	**0,256**	**-0,072**	**-1,388**	**0,646**	**-0,174**
		(0,558)	(-0,315)	(-1,378)	(3,366)	(-0,532)
85	**MAILLIS SA**	**0,367**	**0,157**	**-0,875**	**1,088**	**-0,476**
		(1,046)	(0,898)	(-1,135)	(7,418)	(-1,907)
86	**MESOCHORITIS BROS**	**-0,769**	**-0,555**	**-3,159**	**1,057**	**-0,355**
		(-1,154)	(-1,666)	(-2,156)	(3,788)	(-0,747)
87	**METKA SA**	**0,165**	**0,300**	**-2,835**	**1,100**	**-0,773**
		(0,395)	(1,438)	(-3,093)	(6,302)	(-2,604)
88	**MICHANIKI SA**	**-0,239**	**-0,305**	**-3,243**	**1,282**	**-0,224**
		(-0,574)	(-1,465)	(-3,542)	(7,352)	(-0,755)
89	**MOUZAKIS SA**	**-0,143**	**0,163**	**-0,304**	**0,879**	**-0,325**
		(-0,260)	(0,592)	(-0,252)	(3,816)	(-0,829)
90	**MOCHLOS SA**	**-0,736**	**-0,236**	**-3,264**	**0,893**	**-0,395**
		(-1,209)	(-0,774)	(-2,436)	(3,501)	(-0,911)
91	**BALAFAS SA**	**-0,008**	**-0,157**	**-3,333**	**0,475**	**-0,179**
		(-0,014)	(-0,570)	(-2,745)	(2,053)	(-0,455)
92	**UNCLE STATHIS SA**	**-0,249**	**-0,113**	**-0,939**	**0,642**	**-0,364**
		(-0,643)	(-0,582)	(-1,102)	(3,955)	(-1,319)
93	**BENRUBI SA**	**-0,504**	**-0,343**	**-0,780**	**0,972**	**0,003**
		(-0,838)	(-1,138)	(-0,589)	(3,857)	(0,008)
94	**BITROS HOLDING SA**	**-1,070**	**-0,172**	**-2,452**	**0,831**	**-0,250**
		(-1,838)	(-0,592)	(-1,917)	(3,409)	(-0,604)
95	**BOUTARIS & SON HOLDING SA**	**-0,251**	**-0,353**	**-2,537**	**0,387**	**-1,460**
		(-0,388)	(-1,095)	(-1,788)	(1,433)	(-3,175)
96	**NIKAS SA**	**-0,435**	**0,297**	**-3,268**	**0,938**	**-0,488**
		(-0,740)	(1,010)	(-2,531)	(3,816)	(-1,167)

Note: t-statistics in parenthesis-DEF= default risk INF= inflation rate, RET= real retail sales
TS= term structure

NO	FIRM	DEF	INF	RET	RM	TS
97	PAPASTRATOS CIGARETTE CO	**0,574**	**-0,033**	**-0,831**	**0,541**	**-0,110**
		(1,488)	(-0,171)	(-0,980)	(3,349)	(-0,399)
98	PAVLIDES CONFECTIONARY SA	**-0,173**	**-0,218**	**-1,222**	**0,655**	**-0,749**
		(-0,360)	(-0,905)	(-1,153)	(3,246)	(-2,183)
99	BANK OF PIRAEUS SA	**-0,305**	**0,335**	**-1,181**	**1,153**	**-0,594**
		(-0,831)	(1,825)	(-1,465)	(7,511)	(-2,274)
100	PETZETAKIS SA	**0,051**	**0,034**	**-1,903**	**0,574**	**-0,166**
		(0,095)	(0,128)	(-1,614)	(2,557)	(-0,435)
101	CYCLON HELLAS SA	**0,313**	**-0,250**	**-1,519**	**0,502**	**-0,752**
		(0,473)	(-0,755)	(-1,043)	(1,812)	(-1,595)
102	PROODEFTIKI TECHNICAL COMPANY	**-0,699**	**-0,519**	**-3,612**	**0,986**	**-0,392**
		(-1,274)	(-1,894)	(-2,994)	(4,292)	(-1,004)
103	RADIO ATHENAI SA	**-0,633**	**-0,228**	**-1,959**	**0,560**	**-0,704**
		(-0,961)	(-0,693)	(-1,352)	(2,029)	(-1,500)
104	METAL INDUSTRY OF ARCADIA C. ROKAS SA	**-0,053**	**-0,354**	**-1,585**	**0,971**	**-0,031**
		(-0,107)	(-1,433)	(-1,457)	(4,690)	(-0,087)
105	SANYO HELLAS HOLDING SA	**-1,024**	**-0,100**	**-3,499**	**0,631**	**-1,072**
		(-1,675)	(-0,327)	(-2,603)	(2,465)	(-2,462)
106	SARANTIS SA	**-0,090**	**0,046**	**-2,463**	**0,765**	**-0,297**
		(-0,246)	(0,252)	(-3,049)	(4,971)	(-1,136)
107	C.I. SARANTOPOULOS SA	**-0,421**	**-0,391**	**-2,866**	**0,700**	**-0,515**
		(-0,979)	(-1,817)	(-3,028)	(3,883)	(-1,680)
108	SHELMAN	**0,298**	**0,107**	**-2,452**	**0,904**	**-0,821**
		(0,690)	(0,493)	(-2,577)	(4,992)	(-2,665)
109	SELONTA AQUACULTURES SA	**0,522**	**0,079**	**-1,817**	**0,731**	**-0,715**
		(0,877)	(0,267)	(-1,389)	(2,937)	(-1,689)
110	SIGALAS SA	**-0,290**	**-0,657**	**-0,894**	**1,020**	**-0,236**
		(-0,333)	(-1,509)	(-0,467)	(2,800)	(-0,381)
111	SIDENOR STEEL PRODUCTS MANUFACTURING	**-0,209**	**0,156**	**-2,492**	**0,598**	**-0,498**
		(-0,398)	(0,594)	(-2,161)	(2,722)	(-1,333)
112	STRINTZIS LINES	**0,258**	**0,094**	**-1,913**	**1,009**	**-0,598**
		(0,713)	(0,519)	(-2,402)	(6,652)	(-2,319)
113	TERNA SA	**-1,190**	**-0,280**	**-3,006**	**1,105**	**-0,484**
		(-2,189)	(-1,029)	(-2,516)	(4,854)	(-1,250)
114	VOLOS TECHNICAL COMPANY	**-0,024**	**-0,477**	**-2,266**	**1,102**	**-0,711**
		(-0,055)	(-2,135)	(-2,307)	(5,888)	(-2,233)
115	TECHNICAL OLYMPIC SA	**-0,428**	**-0,278**	**-0,955**	**0,805**	**0,102**
		(-0,723)	(-0,941)	(-0,734)	(3,248)	(0,242)
116	PIPE WORKS GIRAKIAN PROFIL	**-1,218**	**-0,463**	**-0,730**	**0,574**	**-0,230**
		(-2,062)	(-1,567)	(-0,562)	(2,319)	(-0,546)
117	TILETIPOS SA	**0,199**	**0,150**	**-1,633**	**0,648**	**-0,510**
		(0,454)	(0,685)	(-1,692)	(3,523)	(-1,633)
118	TITAN CEMENT CO SA	**0,080**	**0,126**	**-0,679**	**0,855**	**-0,113**
		(0,335)	(1,052)	(-1,287)	(8,504)	(-0,660)
119	BANK OF GREECE	**-0,390**	**0,109**	**-1,418**	**0,712**	**-0,019**
		(-1,028)	(0,574)	(-1,700)	(4,480)	(-0,070)
120	THE PHOENIX GREEK GENERAL INSURANCE	**0,074**	**0,185**	**-1,474**	**0,277**	**-0,225**
		(0,143)	(0,711)	(-1,288)	(1,273)	(-0,607)

Note: t-statistics in parenthesis-DEF= default risk INF= inflation rate, RET= real retail sales
TS= term structure

NO	FIRM	DEF	INF	RET	RM	TS
121	**FOURLIS SA**	**0,143**	**0,040**	**-0,773**	**0,419**	**-1,105**
		(0,221)	(0,124)	(-0,543)	(1,547)	(-2,396)
122	**CHATZIIOANNOU HOLDINGS SA**	**-0,194**	**-0,173**	**-1,405**	**0,659**	**-0,686**
		(-0,389)	(-0,693)	(-1,281)	(3,155)	(-1,931)
123	**ALTEC CA**	**0,358**	**0,136**	**-2,489**	**1,255**	**-1,032**
		(0,861)	(0,654)	(-2,724)	(7,215)	(-3,489)
124	**FLEXOPACK SA PLASTICS**	**0,508**	**-0,022**	**-1,991**	**0,432**	**-0,816**
		(1,312)	(-0,114)	(-2,338)	(2,661)	(-2,958)
125	**JUMBO SA**	**0,026**	**-0,402**	**-0,697**	**0,557**	**-0,180**
		(0,053)	(-1,625)	(-0,642)	(2,690)	(-0,512)
126	**LAMDA DEVELOPMENT SA**	**-0,023**	**-0,277**	**-0,017**	**0,624**	**0,448**
		(-0,031)	(-0,737)	(-0,010)	(1,981)	(0,837)
127	**LAVIPHARM SA**	**0,187**	**-0,261**	**-2,402**	**0,791**	**0,111**
		(0,416)	(-1,157)	(-2,423)	(4,190)	(0,344)
128	**NOTOS COM HOLDINGS SA**	**0,253**	**-0,309**	**-3,197**	**0,765**	**-0,887**
		(0,453)	(-1,107)	(-2,608)	(3,276)	(-2,233)
129	**YALCO-CONSTANTINOU SA**	**-0,920**	**-0,262**	**-0,394**	**0,480**	**-0,507**
		(-1,570)	(-0,893)	(-0,306)	(1,958)	(-1,215)
130	**THE HOUSE OF AGRICULTURE SPIROU SA**	**0,482**	**-0,052**	**-2,850**	**0,722**	**-0,757**
		(1,192)	(-0,256)	(-3,208)	(4,264)	(-2,631)
131	**ATHENA HELL. ENG. IND. & TOUR.**	**-0,431**	**-0,705**	**-2,831**	**0,980**	**-0,196**
		(-0,715)	(-2,340)	(-2,136)	(3,881)	(-0,457)
132	**ALCO HELLAS SA**	**0,331**	**-0,484**	**-2,221**	**0,869**	**-0,932**
		(0,630)	(-1,838)	(-1,920)	(3,942)	(-2,488)
133	**ATEMKE SA**	**-0,695**	**-0,655**	**-1,749**	**0,918**	**-0,241**
		(-1,085)	(-2,045)	(-1,242)	(3,425)	(-0,529)
134	**VERNICOS YACHTS SHIPPING AND HOLDINGS**	**-0,228**	**0,148**	**-0,545**	**0,864**	**-0,707**
		(-0,383)	(0,497)	(-0,416)	(3,459)	(-1,665)
135	**GENER SA**	**0,097**	**-0,357**	**-1,760**	**0,845**	**-0,579**
		(0,156)	(-1,147)	(-1,286)	(3,241)	(-1,307)
136	**ELVAL HELLENIC ALUMINIUM INDUSTRY SA**	**0,286**	**0,010**	**-2,183**	**0,951**	**-0,220**
		(0,886)	(0,063)	(-3,082)	(7,046)	(-0,957)
137	**ELVE SA**	**-0,105**	**-0,140**	**-1,360**	**0,604**	**-0,575**
		(-0,168)	(-0,444)	(-0,984)	(2,295)	(-1,284)
138	**HELLATEX SA SYNTHETIC YARNS**	**-0,939**	**-0,256**	**-1,612**	**0,775**	**-0,441**
		(-1,378)	(-0,751)	(-1,076)	(2,719)	(-0,911)
139	**ESHA SA**	**0,829**	**0,276**	**-1,251**	**0,924**	**0,266**
		(1,170)	(0,779)	(-0,803)	(3,115)	(0,527)
140	**EFKLEIDIS SA**	**0,536**	**-0,251**	**-2,005**	**0,861**	**-0,571**
		(0,964)	(-0,903)	(-1,641)	(3,701)	(-1,441)
141	**EUROPEAN RELIANCE GEN. INS.**	**0,670**	**-0,155**	**-3,205**	**1,217**	**-0,530**
		(1,135)	(-0,525)	(-2,470)	(4,925)	(-1,260)
142	**TECHNODOMI TRAVLOS BROS**	**-1,118**	**-0,682**	**-0,627**	**1,183**	**-0,399**
		(-1,549)	(-1,890)	(-0,395)	(3,918)	(-0,777)
143	**IMPERIO SA**	**-0,117**	**-0,106**	**-0,557**	**0,415**	**-0,651**
		(-0,228)	(-0,412)	(-0,491)	(1,925)	(-1,775)
144	**INTERTECH SA**	**0,347**	**-0,176**	**-2,084**	**0,671**	**-0,181**
		(0,563)	(-0,571)	(-1,538)	(2,598)	(-0,413)

Note: t-statistics in parenthesis-DEF= default risk INF= inflation rate, RET= real retail sales
TS= term structure

NO	FIRM	DEF	INF	RET	RM	TS
145	**CARDASSILARIS - CARDICO SA**	**-0,167**	**0,275**	**-0,642**	**0,532**	**-0,301**
		(-0,462)	(1,521)	(-0,807)	(3,517)	(-1,169)
146	**TEXTILE IND NAFPAKTOS**	**0,404**	**0,034**	**-1,997**	**0,570**	**-0,239**
		(0,683)	(0,114)	(-1,538)	(2,305)	(-0,568)
147	**KNITWEAR FACTORY MAXIM PERTSINIDIS SA**	**0,213**	**0,181**	**-0,741**	**0,822**	**0,081**
		(0,284)	(0,485)	(-0,450)	(2,6210	(0,152)
148	**MEAGA HOLDINGS SA**	**0,040**	**0,079**	**-1,492**	**0,854**	**-0,318**
		(0,044)	(0,171)	(-0,739)	(2,220)	(-0,486)
149	**MYTILINEOS HOLDINGS SA**	**-0,297**	**0,059**	**-1,554**	**0,820**	**-0,837**
		(-0,761)	(0,304)	(-1,808)	(5,010)	(-3,006)
150	**MARITIME COMPANY OF LESVOS**	**-0,427**	**-0,060**	**-2,283**	**0,945**	**0,025**
		(-0,778)	(-0,219)	(-1,894)	(4,119)	(0,065)
151	**NIREFS SA**	**-0,256**	**-0,140**	**-2,327**	**0,843**	**-0,280**
		(-0,541)	(-0,594)	(-2,238)	(4,259)	(-0,8310
152	**HELLENIC TELECOM. ORGANIZATION**	**-0,012**	**0,212**	**-0,822**	**0,591**	**-0,027**
		(-0,044)	(1,554)	(-1,367)	(5,158)	(-0,140)
153	**PAIRIS SA**	**0,183**	**-0,360**	**-2,722**	**0,702**	**-0,350**
		(0,305)	(-1,204)	(-2,071)	(2,805)	(-0,821)
154	**PIRAEUS LEASING**	**0,173**	**0,240**	**-1,757**	**0,611**	**-0,476**
		(0,369)	(1,023)	(-1,705)	(3,110)	(-1,424)
155	**THRACE PLASTICS Co SA**	**0,065**	**0,355**	**-2,280**	**1,294**	**-1,367**
		(0,125)	(1,375)	(-2,009)	(5,989)	(-3,722)
156	**POULIADIS ASSOCIATES CORPORATION**	**0,297**	**0,257**	**-2,644**	**1,171**	**-1,095**
		(0,492)	(0,851)	(-1,989)	(4,629)	(-2,545)
157	**RADIO KORASIDIS COMMERCIAL**	**-0,394**	**-0,175**	**-2,432**	**0,730**	**-0,547**
		(-0,786)	(-0,699)	(-2,206)	(3,477)	(-1,531)
158	**SFAKIANAKIS SA**	**-0,126**	**-0,062**	**-0,919**	**0,992**	**-0,647**
		(-0,232)	(-0,230)	(-0,773)	(4,381)	(-1,680)
159	**TASOGLOU SA - DELONGHI**	**0,175**	**-0,589**	**-3,635**	**0,617**	**-0,264**
		(0,202)	(-1,360)	(-1,910)	(1,701)	(-0,429)
160	**HALCOR SA METAL WORKS**	**0,082**	**0,021**	**-2,872**	**0,782**	**-0,722**
		(0,258)	(0,129)	(-4,116)	5,882)	(-3,197)

Note: t-statistics in parenthesis-DEF= default risk INF= inflation rate, RET= real retail sales
TS= term structure

A/A	**COMPANY**	gen	ftse-20	bank	indu	constr
1	ALBIO HOLDINGS SA	0.00%	0.02%	0.00%	0.00%	0.00%
2	ALFA ALFA HOLDINGS SA	0.00%	0.00%	0.00%	0.00%	0.00%
3	ALPHA BANK SA	3.91%	10.00%	10.79%	1.56%	0.00%
4	ALPHA LEASING SA	0.00%	0.00%	0.00%	1.60%	0.00%
5	AXON SA HOLDING	0.00%	0.00%	0.00%	0.00%	0.00%
6	CHIPITA INTERNATIONAL SA	0.00%	0.00%	0.00%	1.53%	0.00%
7	COCA-COLA HELLENIC BOTTLING COMPANY	5.87%	0.00%	0.00%	1.80%	0.31%
8	ELBISCO HOLDING SA	0.00%	0.00%	0.00%	0.00%	0.00%
9	ELMEC SPORT SA	0.00%	0.00%	0.00%	1.22%	0.00%
10	FANCO SA	0.00%	0.00%	0.00%	0.00%	0.00%
11	FINTEXPORT	10.00%	3.26%	13.01%	3.84%	10.00%
12	GOODY'S SA	0.04%	0.34%	0.00%	0.91%	0.00%
13	HELLAS CAN PACKAGING MANUFACTURERS	0.00%	0.00%	0.00%	0.80%	0.76%
14	INFORM LYCOS	0.00%	0.00%	0.00%	0.00%	0.00%
15	INTRACOM SA	0.00%	0.00%	0.00%	0.30%	0.00%
16	METROLIFE SA	0.00%	0.00%	0.00%	0.00%	0.00%
17	MICROMEDIA BRITANNIA SA	0.00%	0.00%	0.00%	0.00%	0.00%
18	MULTIRAMA SA	0.00%	0.00%	0.00%	0.00%	0.00%
19	NEXANS HELLAS SA	0.31%	0.00%	0.00%	0.87%	0.00%
20	RIDENCO SA	2.11%	0.00%	0.00%	0.00%	0.00%
21	RILKEN SA	0.00%	0.00%	0.00%	0.68%	0.00%
22	SATO SA	0.00%	0.00%	0.00%	0.00%	3.75%
23	DELTA SINGULAR SA	0.00%	0.00%	0.00%	0.00%	0.00%
24	APLHA-BETA VASSILOPOULOS SA	0.00%	0.00%	0.00%	0.00%	0.00%
25	AVAX SA CONSTRUCTION CO	1.25%	0.00%	0.00%	1.00%	0.43%
26	AEGEK SA	0.00%	0.00%	0.00%	0.00%	4.45%
27	AKTOR SA TECHNICAL COMPANY	0.00%	0.00%	0.00%	0.24%	3.29%
28	ALLATINI IND. & COM. CO	0.00%	0.00%	0.00%	0.11%	0.01%
29	ALUMINIUM OF GREECE SA	3.05%	6.63%	5.17%	1.99%	0.00%
30	ALTE TECHNICAL COMPANY	0.00%	0.00%	0.00%	0.00%	0.44%
31	SILVER & BARYTE ORES MINING CO	1.76%	10.00%	4.01%	2.20%	0.00%
32	ASPIS PRONOIA GENERAL INSURANCES SA	0.00%	0.00%	0.00%	1.08%	0.00%
33	ATTIKAT SA	1.69%	0.00%	0.00%	0.39%	4.67%
34	BIOSSOL SA	0.00%	0.00%	0.00%	0.00%	0.00%
35	VIOTER SA	0.00%	0.00%	0.00%	0.00%	0.00%
36	VIOHALCO	0.00%	0.30%	0.00%	1.50%	0.00%
37	VIS CONTAINER MANUFACTORING	0.00%	0.00%	0.00%	0.00%	0.00%
38	GENERAL COMMERCIAL & INDUSTRIAL SA	0.00%	0.00%	0.00%	0.00%	0.00%
39	GENERAL CONSTRUCTION COMPANY	0.00%	0.00%	0.00%	0.00%	0.47%
40	GEKAT CONSTRUCTION COMPANY	0.00%	0.00%	0.00%	0.00%	0.00%
41	GENERAL HELLENIC BANK	0.00%	0.00%	0.00%	0.50%	0.00%
42	GNOMON CONSTRUCTION CO. SA	0.00%	0.00%	0.00%	0.00%	1.37%
43	DARING S.A.I.N.	0.00%	0.00%	0.00%	0.00%	4.21%
44	DELTA HOLDINGS SA	1.01%	0.00%	0.00%	1.64%	0.14%
45	DIEKAT SA	0.00%	0.00%	0.00%	0.00%	0.00%
46	HELLENIC SUGAR INDUSTRY SA	10.00%	6.56%	7.74%	13.67%	0.00%

47	EGNATIA BANK SA	0.00%	0.00%	0.00%	0.00%	0.00%
48	EDRASIS-PSALLIDAS SA	0.00%	0.00%	0.00%	0.00%	0.00%
49	N.B.G. REAL ESTATE DEVELOPMENT CO	0.00%	0.40%	0.00%	0.00%	0.00%
50	ETHNIKI GREEK GENERAL INSURANCE CO	0.00%	0.00%	0.00%	0.00%	0.10%
51	NATIONAL BANK OF GREECE	4.94%	9.99%	15.00%	0.98%	0.13%
52	EKTER SA	0.00%	0.00%	0.00%	0.00%	2.94%
53	ELAIS OLEAGINOUS PROD. SA	0.00%	0.00%	0.00%	1.32%	0.00%
54	HELLENIC CABLES SA	0.00%	0.00%	0.00%	0.69%	0.00%
55	HELLENIC FABRICS SA	0.00%	0.00%	0.00%	0.00%	0.62%
56	HELLENIC TECHNODOMIKI SA	0.00%	0.00%	0.00%	0.14%	3.83%
57	ELTRAK SA	0.00%	0.00%	0.00%	0.00%	1.28%
58	ELFICO SA	0.00%	0.00%	0.00%	0.00%	0.00%
59	COMMERCIAL BANK OF GREECE	1.27%	0.00%	0.00%	0.75%	0.00%
60	SELECTED TEXTILE INDUSTRIES ASSOCIATION	0.00%	0.00%	0.00%	0.00%	0.00%
61	HELLENIC EXCHANGES SA	0.00%	0.04%	0.00%	0.96%	0.00%
62	ERGAS SA	0.00%	0.00%	0.00%	0.00%	4.38%
63	N.I.B.I.D.	2.80%	10.00%	4.24%	2.27%	0.00%
64	ETEM SA LIGHT METALS INDUSTRY	0.00%	0.00%	0.00%	0.54%	0.00%
65	ETMA RAYON	0.00%	0.00%	0.00%	0.00%	0.00%
66	EUROPEAN TECHNICAL SA	9.71%	0.00%	0.07%	2.56%	2.53%
67	ZAMPA SA	0.00%	4.16%	0.00%	1.60%	0.00%
68	HERACLES GENERAL CEMENT COMPANY	0.00%	0.00%	0.00%	0.96%	0.00%
69	THEMELIODOMI SA	0.00%	0.00%	0.00%	0.90%	0.00%
70	ATHENS MEDICAL C.S.A.	0.00%	0.29%	0.00%	0.02%	0.00%
71	IONIAN HOTEL ENTERPRISES SA	0.00%	0.00%	0.00%	0.00%	0.00%
72	HIPPOTOUR SA	0.00%	0.00%	0.00%	0.00%	0.00%
73	KALPINIS-SIMOS STEEL SERVICE CENTER	0.00%	0.00%	0.00%	0.00%	0.00%
74	KARELIA TOBACCO COMPANY INC SA	0.00%	0.00%	0.00%	1.08%	0.00%
75	KATSELIS SA BREAD INDUSTRY	0.00%	0.00%	0.00%	0.18%	0.00%
76	KEKROPS HOTEL TOURIST. BUILD.	0.00%	0.00%	0.00%	1.46%	0.00%
77	KERAMIA-ALLATINI	0.00%	0.00%	0.00%	0.72%	0.00%
78	KLONATEX GROUP OF COMPANIES SA	0.00%	0.00%	0.00%	0.00%	0.00%
79	NAOUSSA SPINNING MILLS SA	0.99%	8.11%	12.31%	0.00%	0.00%
80	KRE.KA SA	0.22%	0.00%	0.00%	1.21%	0.16%
81	LAPSA HOTEL CO	0.00%	0.00%	0.00%	0.00%	0.19%
82	LANAKAM SA	0.00%	0.00%	0.00%	0.53%	0.00%
83	LEVEDERIS SA	0.00%	0.00%	0.00%	0.00%	0.00%
84	LOULIS MILLS SA	0.00%	0.00%	0.00%	1.27%	0.00%
85	MAILLIS SA	0.04%	0.00%	0.00%	1.34%	0.08%
86	MESOCHORITIS BROS	0.00%	0.00%	0.00%	0.00%	1.48%
87	METKA SA	0.00%	0.00%	0.00%	0.03%	0.00%
88	MICHANIKI SA	0.00%	0.00%	0.00%	0.22%	3.99%
89	MOUZAKIS SA	0.98%	0.00%	0.00%	1.36%	0.00%
90	MOCHLOS SA	0.00%	0.00%	0.00%	0.00%	0.00%
91	BALAFAS SA	0.00%	0.00%	0.00%	0.10%	0.00%
92	UNCLE STATHIS SA	0.00%	0.00%	0.00%	0.48%	0.00%
93	BENRUBI SA	0.98%	0.00%	0.00%	0.58%	0.79%
94	BITROS HOLDING SA	0.00%	0.00%	0.00%	0.00%	0.00%

95	BOUTARIS & SON HOLDING SA	0.00%	0.00%	0.00%	0.00%	0.00%
96	NIKAS SA	0.23%	0.29%	0.00%	0.00%	0.00%
97	PAPASTRATOS CIGARETTE CO	5.71%	0.04%	0.00%	2.01%	0.00%
98	PAVLIDES CONFECTIONARY SA	0.00%	0.00%	0.00%	0.00%	0.00%
99	BANK OF PIRAEUS SA	1.94%	0.67%	0.00%	0.60%	0.00%
100	PETZETAKIS SA	0.00%	0.30%	0.00%	1.06%	0.00%
101	CYCLON HELLAS SA	0.00%	0.00%	0.00%	0.00%	0.00%
102	PROODEFTIKI TECHNICAL COMPANY	0.00%	0.00%	0.00%	0.00%	0.31%
103	RADIO ATHENAI SA	0.00%	0.00%	0.00%	0.00%	0.00%
104	METAL INDUSTRY OF ARCADIA C. ROKAS SA	0.00%	0.00%	0.00%	0.64%	1.96%
105	SANYO HELLAS HOLDING SA	0.00%	0.00%	0.00%	0.00%	0.00%
106	SARANTIS SA	0.00%	0.00%	0.00%	0.44%	0.00%
107	C.I. SARANTOPOULOS SA	0.00%	0.00%	0.00%	0.00%	0.00%
108	SHELMAN	0.00%	0.00%	0.00%	0.00%	0.00%
109	SELONTA AQUACULTURES SA	0.00%	0.00%	0.00%	0.56%	0.00%
110	SIGALAS SA	0.00%	0.00%	0.00%	0.76%	10.00%
111	SIDENOR STEEL PRODUCTS MANUFACTURING	0.00%	0.39%	0.00%	0.12%	0.00%
112	STRINTZIS LINES	0.00%	0.00%	0.00%	0.48%	0.00%
113	TERNA SA	0.00%	0.00%	0.00%	0.00%	0.04%
114	VOLOS TECHNICAL COMPANY	0.00%	0.00%	0.00%	0.00%	2.67%
115	TECHNICAL OLYMPIC SA	0.92%	0.00%	0.00%	0.91%	0.20%
116	PIPE WORKS GIRAKIAN PROFIL	0.00%	0.00%	0.00%	0.00%	0.00%
117	TILETIPOS SA	0.00%	0.12%	0.00%	0.83%	0.00%
118	TITAN CEMENT CO SA	1.63%	0.00%	0.27%	1.80%	0.00%
119	BANK OF GREECE	1.86%	10.00%	2.02%	1.20%	0.00%
120	THE PHOENIX GREEK GENERAL INSURANCE	3.85%	1.24%	0.00%	7.81%	0.00%
121	FOURLIS SA	0.00%	0.00%	0.00%	0.00%	0.00%
122	CHATZIIOANNOU HOLDINGS SA	0.00%	0.00%	0.00%	0.00%	0.00%
123	ALTEC CA	0.00%	0.00%	0.00%	0.00%	0.37%
124	FLEXOPACK SA PLASTICS	0.00%	0.00%	0.00%	0.13%	0.00%
125	JUMBO SA	0.00%	0.00%	0.00%	0.73%	0.00%
126	LAMDA DEVELOPMENT SA	4.67%	0.00%	0.00%	2.39%	0.01%
127	LAVIPHARM SA	0.00%	0.00%	0.00%	1.03%	0.13%
128	NOTOS COM HOLDINGS SA	0.00%	0.00%	0.00%	0.00%	0.00%
129	YALCO-CONSTANTINOU SA	0.00%	0.00%	0.00%	0.00%	0.00%
130	THE HOUSE OF AGRICULTURE SPIROU SA	0.00%	0.00%	0.00%	0.00%	0.00%
131	ATHENA HELL. ENG. IND. & TOUR.	0.00%	0.00%	0.00%	0.00%	5.68%
132	ALCO HELLAS SA	0.00%	0.00%	0.00%	0.00%	5.25%
133	ATEMKE SA	0.00%	0.00%	0.00%	0.00%	1.41%
134	VERNICOS YACHTS SHIPPING AND HOLDINGS	0.00%	0.00%	0.00%	0.40%	0.00%
135	GENER SA	0.00%	0.00%	0.00%	0.00%	0.03%
136	ELVAL HELLENIC ALUMINIUM INDUSTRY SA	0.00%	0.00%	0.00%	1.01%	0.00%
137	ELVE SA	0.00%	0.00%	0.00%	0.00%	0.00%
138	HELLATEX SA SYNTHETIC YARNS	0.00%	0.00%	0.00%	0.00%	0.00%
139	ESHA SA	10.00%	0.00%	15.00%	0.00%	6.49%
140	EFKLEIDIS SA	0.00%	0.00%	0.00%	0.21%	0.03%
141	EUROPEAN RELIANCE GEN. INS.	0.00%	0.00%	0.00%	0.00%	5.18%
142	TECHNODOMI TRAVLOS BROS	0.00%	0.00%	0.00%	0.00%	3.44%
143	IMPERIO SA	0.00%	0.00%	0.00%	0.23%	0.00%

144	INTERTECH SA	0.00%	0.00%	0.00%	0.90%	0.00%
145	CARDASSILARIS - CARDICO SA	0.00%	0.84%	0.00%	1.70%	0.00%
146	TEXTILE IND NAFPAKTOS	0.00%	0.22%	0.00%	1.24%	0.00%
147	KNITWEAR FACTORY MAXIM PERTSINIDIS SA	3.09%	10.00%	8.69%	2.39%	0.00%
148	MEAGA HOLDINGS SA	0.00%	0.00%	0.00%	0.96%	0.00%
149	MYTILINEOS HOLDINGS SA	0.00%	0.00%	0.00%	0.00%	0.00%
150	MARITIME COMPANY OF LESVOS	1.92%	4.42%	0.00%	0.66%	0.00%
151	NIREFS SA	0.00%	0.00%	0.00%	0.03%	0.00%
152	HELLENIC TELECOM. ORGANIZATION CO	1.25%	0.82%	1.68%	1.99%	0.00%
153	PAIRIS SA	0.00%	0.00%	0.00%	0.00%	0.00%
154	PIRAEUS LEASING	0.00%	0.53%	0.00%	0.98%	0.00%
155	THRACE PLASTICS Co SA	0.00%	0.00%	0.00%	0.00%	0.00%
156	POULIADIS ASSOCIATES CORPORATION	0.00%	0.00%	0.00%	0.00%	0.00%
157	RADIO KORASIDIS COMMERCIAL	0.00%	0.00%	0.00%	0.00%	0.00%
158	SFAKIANAKIS SA	0.00%	0.00%	0.00%	0.11%	0.01%
159	TASOGLOU SA - DELONGHI	0.00%	0.00%	0.00%	0.00%	0.00%
160	HALCOR SA METAL WORKS	0.00%	0.00%	0.00%	0.00%	0.00%

APPENDIX D: PASSIVE PORTFOLIOS

Portfolio 1: Tracking the ASE-60 Index		
No	**FIRM**	**WEIGHTS**
1	HELLENIC SUGAR INDUSTRY SA	10.00%
2	ESHA SA	10.00%
3	FINTEXPORT	10.00%
4	EUROPEAN TECHNICAL SA	9.71%
5	COCA-COLA HELLENIC BOTTLING COMPANY	5.87%
6	PAPASTRATOS CIGARETTE CO	5.71%
7	NATIONAL BANK OF GREECE	4.94%
8	LAMDA DEVELOPMENT SA	4.67%
9	ALPHA BANK SA	3.91%
10	THE PHOENIX GREEK GENERAL INSURANCE	3.85%
11	KNITWEAR FACTORY MAXIM PERTSINIDIS SA	3.09%
12	ALUMINIUM OF GREECE SA	3.05%
13	N.I.B.I.D.	2.80%
14	RIDENCO SA	2.11%
15	BANK OF PIRAEUS SA	1.94%
16	MARITIME COMPANY OF LESVOS	1.92%
17	BANK OF GREECE	1.86%
18	SILVER & BARYTE ORES MINING CO	1.76%
19	ATTIKAT SA	1.69%
20	TITAN CEMENT CO SA	1.63%
21	COMMERCIAL BANK OF GREECE	1.27%
22	HELLENIC TELECOM. ORGANIZATION	1.25%
23	AVAX SA CONSTRUCTION CO	1.25%
24	DELTA HOLDINGS SA	1.01%
25	NAOUSSA SPINNING MILLS SA	0.99%
26	MOUZAKIS SA	0.98%
27	BENRUBI SA	0.98%
28	TECHNICAL OLYMPIC SA	0.92%
29	NEXANS HELLAS SA	0.31%
30	NIKAS SA	0.23%
31	KRE.KA SA	0.22%
32	GOODY'S SA	0.04%
33	MAILLIS SA	0.04%

Portfolio 2: Tracking the FTSE-20 Index		
No	**FIRM**	**WEIGHTS**
1	ALPHA BANK SA	10.00%
2	SILVER & BARYTE ORES MINING CO	10.00%
3	N.I.B.I.D.	10.00%
4	KNITWEAR FACTORY MAXIM PERTSINIDIS SA	10.00%
5	BANK OF GREECE	10.00%
6	NATIONAL BANK OF GREECE	9.99%
7	NAOUSSA SPINNING MILLS SA	8.11%
8	ALUMINIUM OF GREECE	6.63%
9	HELLENIC SUGAR INDUSTRY SA	6.56%
10	MARITIME COMPANY OF LESVOS	4.42%
11	ZAMPA SA	4.16%
12	FINTEXPORT	3.26%
13	THE PHOENIX GREEK GENERAL INSURANCE	1.24%
14	CARDASSILARIS - CARDICO SA	0.84%
15	HELLENIC TELECOM. ORGANIZATION CO	0.82%
16	BANK OF PIRAEUS SA	0.67%
17	PIRAEUS LEASING	0.53%
18	N.B.G. REAL ESTATE DEVELOPMENT CO	0.40%
19	SIDENOR STEEL PRODUCTS MANUFACTURING	0.39%
20	GOODY'S SA	0.34%
21	VIOHALCO	0.30%
22	PETZETAKIS SA	0.30%
23	ATHENS MEDICAL C.S.A.	0.29%
24	NIKAS SA	0.29%
25	TEXTILE IND NAFPAKTOS	0.22%
26	TILETIPOS SA	0.12%
27	HELLENIC EXCHANGES	0.07%
28	PAPASTRATOS CIGARETTE CO	0.04%

Portfolio 3: Tracking the ASE Industrial Index

No	FIRM	WEIGHTS	No	FIRM	WEIGHTS
1	HELLENIC SUGAR INDUSTRY	13.67%	40	MEAGA HOLDINGS SA	0.96%
2	THE PHOENIX GREEK GENERAL INSURANCE	7.81%	41	GOODY'S SA	0.91%
3	FINTEXPORT	3.84%	42	TECHNICAL OLYMPIC SA	0.91%
4	EUROPEAN TECHNICAL SA	2.56%	43	THEMELIODOMI SA	0.90%
5	KNITWEAR FACTORY MAXIM PERTSINIDIS SA	2.39%	44	INTERTECH SA	0.90%
6	LAMDA DEVELOPMENT SA	2.39%	45	NEXANS HELLAS SA	0.87%
7	N.I.B.I.D.	2.27%	46	TILETIPOS SA	0.83%
8	SILVER & BARYTE ORES MINING CO	2.20%	47	HELLAS CAN PACKAGING MANUFACTURERS	0.80%
9	PAPASTRATOS CIGARETTE CO	2.01%	48	SIGALAS SA	0.76%
10	HELLENIC TELECOM. ORGANIZATION CO	1.99%	49	COMMERCIAL BANK OF GREECE	0.75%
11	ALUMINIUM OF GREECE SA	1.99%	50	JUMBO SA	0.73%
12	TITAN CEMENT CO SA	1.80%	51	KERAMIA-ALLATINI	0.72%
13	COCA-COLA HELLENIC BOTTLING COMPANY	1.80%	52	HELLENIC CABLES SA	0.69%
14	CARDASSILARIS - CARDICO SA	1.70%	53	RILKEN SA	0.68%
15	DELTA HOLDINGS SA	1.64%	54	MARITIME COMPANY OF LESVOS	0.66%
16	ZAMPA SA	1.60%	55	METAL INDUSTRY OF ARCADIA C. ROKAS SA	0.64%
17	ALPHA LEASING SA	1.60%	56	BANK OF PIRAEUS SA	0.60%
18	ALPHA BANK SA	1.56%	57	BENRUBI SA	0.58%
19	CHIPITA INTERNATIONAL SA	1.53%	58	SELONTA AQUACULTURES SA	0.56%
20	VIOHALCO	1.50%	59	ETEM SA LIGHT METALS INDUSTRY	0.54%
21	KEKROPS HOTEL TOURIST.	1.46%	60	LANAKAM SA	0.53%
22	MOUZAKIS SA	1.36%	61	GENERAL HELLENIC BANK	0.50%
23	MAILLIS SA	1.34%	62	STRINTZIS LINES	0.48%
24	ELAIS OLEAGINOUS PROD. SA	1.32%	63	UNCLE STATHIS SA	0.48%
25	LOULIS MILLS SA	1.27%	64	SARANTIS SA	0.44%
26	TEXTILE IND NAFPAKTOS	1.24%	65	VERNICOS YACHTS SHIPPING AND HOLDINGS	0.40%
27	ELMEC SPORT SA	1.22%	66	ATTIKAT SA	0.39%
28	KRE.KA SA	1.21%	67	INTRACOM SA	0.30%
29	BANK OF GREECE	1.20%	68	AKTOR SA TECHNICAL COMPANY	0.24%
30	ASPIS PRONOIA GENERAL INSURANCES SA	1.08%	69	IMPERIO SA	0.23%
31	ARELIA TOBACCO COMPANY INC	1.08%	70	MICHANIKI SA	0.22%
32	PETZETAKIS SA	1.06%	71	EFKLEIDIS SA	0.21%
33	LAVIPHARM SA	1.03%	72	KATSELIS SA BREAD INDUSTRY	0.18%
34	ELVAL HELLENIC ALUMINIUM INDUSTRY SA	1.01%	73	HELLENIC TECHNODOMIKI SA	0.14%
35	AVAX SA CONSTRUCTION CO	1.00%	74	FLEXOPACK SA PLASTICS	0.14%
36	NATIONAL BANK OF GREECE	0.98%	75	SIDENOR STEEL PRODUCTS MANUFACTURING	0.13%
37	PIRAEUS LEASING	0.98%	76	ALLATINI IND. & COM. CO	0.13%
38	HELLENIC EXCHANGES SA	0.96%	77	SFAKIANAKIS SA	0.12%
39	HERACLES GENERAL CEMENT COMPANY	0.96%	78	BALAFAS SA	0.12%

Portfolio 4: Tracking the ASE Construction Index		
No	FIRM	WEIGHTS
1	FINTEXPORT	10.00%
2	SIGALAS SA	10.00%
3	ESHA SA	6.49%
4	ATHENA HELL. ENG. IND. & TOUR.	5.68%
5	ALCO HELLAS SA	5.25%
6	EUROPEAN RELIANCE GEN. INS.	5.18%
7	ATTIKAT SA	4.67%
8	AEGEK SA	4.45%
9	ERGAS SA	4.38%
10	DARING S.A.I.N.	4.21%
11	MICHANIKI SA	3.99%
12	HELLENIC TECHNODOMIKI SA	3.83%
13	SATO SA	3.75%
14	TECHNODOMI TRAVLOS BROS	3.44%
15	AKTOR SA TECHNICAL COMPANY	3.29%
16	EKTER SA	2.94%
17	VOLOS TECHNICAL COMPANY	2.67%
18	EUROPEAN TECHNICAL SA	2.53%
19	METAL INDUSTRY OF ARCADIA C. ROKAS SA	1.96%
20	MESOCHORITIS BROS	1.48%
21	ATEMKE SA	1.41%
22	GNOMON CONSTRUCTION CO. SA	1.37%
23	ELTRAK SA	1.28%
24	BENRUBI SA	0.79%
25	HELLAS CAN PACKAGING MANUFACTURERS	0.76%
26	HELLENIC FABRICS SA	0.62%
27	GENERAL CONSTRUCTION COMPANY	0.47%
28	ALTE TECHNICAL COMPANY	0.44%
29	AVAX SA CONSTRUCTION CO	0.43%
30	ALTEC CA	0.37%
31	PROODEFTIKI TECHNICAL COMPANY	0.31%
32	COCA-COLA HELLENIC BOTTLING COMPANY	0.31%
33	TECHNICAL OLYMPIC SA	0.20%
34	LAPSA HOTEL CO	0.19%
35	KRE.KA SA	0.16%
36	DELTA HOLDINGS SA	0.14%
37	NATIONAL BANK OF GREECE	0.13%
38	LAVIPHARM SA	0.13%
39	ETHNIKI GREEK GENERAL INSURANCE CO	0.10%
40	MAILLIS SA	0.08%
41	TERNA SA	0.04%
42	GENER SA	0.04%
43	EFKLEIDIS SA	0.03%

Portfolio 5: Tracking the ASE Banking Index		
No	FIRM	WEIGHTS
1	NATIONAL BANK OF GREECE	15.00%
2	ESHA SA	15.00%
3	FINTEXPORT	13.01%
4	NAOUSSA SPINNING MILLS SA	12.31%
5	ALPHA BANK SA	10.79%
6	KNITWEAR FACTORY MAXIM PERTSINIDIS SA	8.69%
7	HELLENIC SUGAR INDUSTRY SA	7.74%
8	ALUMINIUM OF GREECE SA	5.17%
9	N.I.B.I.D.	4.24%
10	SILVER & BARYTE ORES MINING CO	4.01%
11	BANK OF GREECE	2.02%
12	HELLENIC TELECOM. ORGANIZATION CO	1.68%
13	TITAN CEMENT CO SA	0.27%
14	EUROPEAN TECHNICAL SA	0.07%

APPENDIX E: ACTIVE PORTFOLIOS

PERIOD 1: OCTOBER 2001

Portfolio 1: Bet on default risk		
No	**FIRM**	**WEIGHTS**
1	NATIONAL BANK OF GREECE	25.20%
2	NAOUSSA SPINNING MILLS	22.83%
3	LAMDA DEVELOPMENT SA	20.01%
4	FINTEXPORT	17.41%
5	HELLENIC TELECOM. ORGANIZATION CO	14.56%

Portfolio 2: Bet on inflation risk		
No	**FIRM**	**WEIGHTS**
1	LAMDA DEVELOPMENT SA	16.77%
2	ATHENA HELL. ENG. IND. & TOUR. CO	15.22%
3	SIGALAS SA	14.57%
4	HELLENIC TECHNODOMIKI	10.57%
5	ATTIKAT SA	10.33%
6	AEGEK SA	9.76%
7	SATO SA	7.35%
8	AKTOR SA TECHNICAL COMPANY	7.09%
9	HELLAS CAN PACKAGING MANUFACTURERS SA	5.69%
10	METAL INDUSTRY OF ARCADIA C. ROKAS SA	1.69%
11	ERGAS SA	0.47%
12	MULTIRAMA SA	0.31%
13	TECHNODOMI TRAVLOS BROS	0.18%

Portfolio 3: Bet on business cycle risk		
No	**FIRM**	**WEIGHTS**
1	EUROPEAN TECHNICAL SA	37.27%
2	ESHA SA	30.54%
3	ATHENS MEDICAL C.S.A.	26.88%
4	NIKAS SA	4.46%
5	N.B.G. REAL ESTATE DEVELOPMENT CO	0.84%

Portfolio 4: Bet on confidence risk		
No	**FIRM**	**WEIGHTS**
1	ALPHA BANK SA	15.00%
2	ALUMINIUM OF GREECE SA	15.00%
3	NATIONAL BANK OF GREECE	15.00%
4	ESHA SA	15.00%
5	MARITIME COMPANY OF LESVOS	15.00%
6	LAMDA DEVELOPMENT SA	13.20%
7	FINTEXPORT	8.05%
8	EUROPEAN TECHNICAL SA	1.59%
9	KNITWEAR FACTORY MAXIM PERTSINIDIS	1.10%
10	MICHANIKI SA	1.06%

Portfolio 5: Combined bets on factor risks		
No	**FIRM**	**WEIGTHS**
1	ALCO HELLAS SA	20.00%
2	ESHA SA	20.00%
3	EFKLEIDIS SA	20.00%
4	EUROPEAN RELIANCE GEN. INS. SA	20.00%
5	SATO SA	14.72%
6	HELLENIC SUGAR INDUSTRY	4.33%
7	PAPASTRATOS CIGARETTE CO	0.95%

PERIOD 2: NOVEMBER 2001

Portfolio 1: Bet on default risk		
No	FIRM	WEIGHTS
1	ESHA SA	48.74%
2	EUROPEAN RELIANCE GEN. INS. SA	22.20%
3	HELLENIC FABRICS SA	13.99%
4	MAILLIS SA	11.82%
5	HELLENIC TECHNODOMIKI	3.25%

Portfolio 2: Bet on inflation risk		
No	FIRM	WEIGHTS
1	LAMDA DEVELOPMENT SA	16.77%
2	ATHENA HELL. ENG. IND. & TOUR. CO	15.22%
3	SIGALAS SA	14.57%
4	HELLENIC TECHNODOMIKI	10.57%
5	ATTIKAT SA	10.33%
6	AEGEK SA	9.76%
7	SATO SA	7.35%
8	AKTOR SA TECHNICAL COMPANY	7.09%
9	HELLAS CAN PACKAGING MANUFACTURERS SA	5.69%
10	METAL INDUSTRY OF ARCADIA C. ROKAS SA	1.69%
11	ERGAS SA	0.47%
12	MULTIRAMA SA	0.31%
13	TECHNODOMI TRAVLOS BROS	0.18%

Portfolio 3: Bet on business cycle risk		
No	FIRM	WEIGHTS
1	COCA-COLA HELLENIC BOTTLING COMPANY SA	48.77%
2	KNITWEAR FACTORY MAXIM PERTSINIDIS SA	17.38%
3	NATIONAL BANK OF GREECE	15.09%
4	FINTEXPORT	11.12%
5	ESHA SA	7.64%

Portfolio 4: Bet on confidence risk		
No	FIRM	WEIGHTS
1	ALPHA BANK SA	15.00%
2	ALUMINIUM OF GREECE SA	15.00%
3	NATIONAL BANK OF GREECE	15.00%
4	ESHA SA	15.00%
5	MARITIME COMPANY OF LESVOS	15.00%
6	LAMDA DEVELOPMENT SA	13.20%
7	FINTEXPORT	8.05%
8	EUROPEAN TECHNICAL SA	1.59%
9	KNITWEAR FACTORY MAXIM PERTSINIDIS	1.10%
10	MICHANIKI SA	1.06%

Portfolio 5: Combined bets on factor risks		
No	FIRM	WEIGTHS
1	FINTEXPORT	20.00%
2	BIOSSOL SA	20.00%
3	TECHNODOMI TRAVLOS BROS	20.00%
4	MULTIRAMA SA	15.83%
5	HELLENIC FABRICS SA	13.99%
6	MICROMEDIA BRITANNIA SA	10.14%
7	DARING S.A.I.N.	0.05%