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Identification of Risk Factors by Using Macroeconomic and Firm-Specific Variables Simultaneously in Tehran Stock Exchange by Applying Canonical Correlation Analysis

Pooya Sabetfar
Assistant Professor, Department of Management, Faculty of Management and Accounting, Islamic Azad University,Qazvin Branch, Qazvin, Iran.
p_sabetfar@yahoo.com

ABSTRACT

The main objective of this study is to give the insight of describing mixing accounting ratios and macroeconomic variables as the risk factors in Iran. The results indicate a significant relationship between book to market ratio, financial leverage, size factors and expected stock returns in the Iranian market. In consistent with the other studies, we came to the conclusion that the term structure of interest rate is the only macroeconomic variable that has been significant in the model, if size and book to market ratio is also existed in the model.Maximum %28 of variance explained by canonical variate.

Keywords:

Accounting ratios, Macroeconomic variables, Combine Variabels, Arbitrage Pricing Theory and Canonical Correlation Analysis.

1. Introduction

The expected returns of securities that are indicated by asset pricing theories concern their sensitivity to the changes in the form of the economy. Sharpe (1964), Lintner (1965), Mossin (1966) and Black (1972), in the capital asset pricing model (CAPM), explained that this sensitivity is measured by only macroeconomic variables, that is, the securities b's coefficients with a mean-variance efficient market portfolio. Intertemporal models (Merton, 1973 Long 1974, Lucas 1978, and Breeden1979) and the arbitrage pricing theory (APT) of Ross (1976) provided evidence that the small number of macroeconomic variables explain the relationship between average returns and systematic risks.

In the Arbitrage Pricing Theory (APT) literature that was originally developed by Ross (1976), the researcher casts doubt upon the predictions of capital asset pricing model (CAPM).The APT, in fact, has been recommended by investigators, especially Roll and Ross, (1980), as a testable alternative and feasibly natural successor to the CAPM. Chen and Bower (1983) and Bower and Logue (1984) showed empirical evidence in favor of the APT. These major theoretical contributions have made ample empirical studies such as the study on a single risk premium perspective and consecutively within a multi-factor structure. Many studies found the relationship between stock returns and some fundamentals, where the selection of the economic variables has been directed basically either by intuition (Chen, Roll and Ross (CRR) 1986), or by their acceptance among market contributors. The size effect of Banz (1981) and the Price for earnings ratio effect of Basu (1983) are the most primary examples.

In explaining equilibrium prices Roll and Ross (1980) found that two to four factors are significant. In explaining expected stock returns, Chen, Roll and Ross (CRR) (1986) concluded that five macro variables are significant. It is known as Macroeconomic Variables Model. They are the unanticipated change in term structure, the change in expected inflation, the unanticipated inflation rate, the unanticipated change in the growth rate in industrial production, and the unanticipated change in risk premium.

Fama and French (1992) also use particular factors as variables. Instead of using macro-economic variables, nevertheless, they use firm variables like size (market value of equity), book-to- market equity, price to earning ratio and leverage. It is recognized as Firm Variables Model.

While market indices are helpful in clarifying time-series return variation, CRR also found that they cannot explain in expected returns the cross-sectional distinctions once macro variables are involved in the model. He and Ng (1994), in addition, combine the five CRR macro variables, the market index in their pricing model and the two significant firm-specific variables found in Fama and French (1992). The cross-sectional variation of average stock returns is not elucidated by either the macro variables, when the firm-specific variables in the model are included, or the market index. These findings increase the concerns on the helpfulness of the APT in clarifying security returns.

Over the past few decades, the relations of return and risk with the macroeconomic and accounting variables have been an issue of attention among researchers. The APT has been empirically investigated in several markets, e.g., Chen and Hsieh, (1986) to New York Stock Exchange market, Berry *et al.*, (1988) to S&P 500, Antoniou, Garrette and Priestley, (1998) applied it to London Stock Exchange, Dhankar and Esq (2005) to Indian Stock Market, Anatolyev (2005) to Russian Stock Markets Azeez & Yonezawa (2006) to Japanese Stock Market and lastly Ariff and Lim (2007) to Malaysian Stock Market.This study provides a test of APT for Tehran stock market and tries to find the relevant factors priced on it.

The stock exchange market of Tehran is the main part of capital market of Iran which its background is more than four decades. Since the beginning of 1967 it has been established with 5 firms and up to 1979 the numbers of the firms were increased up to 105. Due to the war between Iran and Iraq in 1980, stock exchange of Tehran has been closed temporarily for 6 years (1984-1989), and since from the end of 1989 it started again. In 201٦, the number of firms in Tehran exchange market (TSE) was٣٢٥ (TSE bulletin, 201٦). Also in the last decade TSE has the most active period in contrast to other times and has the most cyclical fluctuations which are affected by the market performance as well as its relation with other economical sections. Despite a number of potential opportunities for investing in TSE, it could not find its real place in economy and could absorb only small amount of savings. For instance, the value of market capitalization was only 15.4% of GDP in 2014(TSE

bulletin, 2014). Maybe one of the significant reasons is the macroeconomic variables which faced to fluctuate a lot in overtime and international sanction that imposed to Iran, created insecure situation for investing in stock market.

Changes in macroeconomic variable affect stock market return and its volatility and then fluctuation and restriction in economy affectfirm variables in the stock market. Bythe both company decision makers, investors and economic decision makers, Combine variable model (CVM) is important. Given establishment of economic suggestion of firm-specific distinctiveness and to handle their perceived prospect economic situation, a variety of strategic policies (e.g. capital structure and dividend policy) can be developed by policymakers. To the best of our knowledge, this is the first research that tests the APT in Tehran stock market with combine (macroeconomic plus accounting) variables concurrently. This study provides a test of the APT for Iranian stock market with respect to several variables that could affect stock return in Tehran stock market as the Iranian largest capital market.

Nonetheless, although some studies have been accomplished before, like Rahmani and Sheri (2006) and Mohseni (2007)**,** but due to the short period of those studies and non-attention to macro and accounting effective variables on stock exchange simultaneously, the researcher stimulated to examine this study with the fairly acceptable period of 1991-2010 and with more economic variables (8variables) and seven accounting variables as 15 combine variables. Because efficient market is an essential assumption in CAPM theory and since Tehran stock Exchange Market is not efficient (Nateghi and Ghlibaf, 2006), so this research employs APT for studying asset pricing theory in TSE.

The general objective of this study is to test the applicability of the APT as a theory of asset pricing in Tehran Stock Exchange (TSE). The specific objectives are as follows: 1) To test the application of APT in TSE by using macroeconomic and accounting variables simultaneously as the combine variables. 2) To examine which variables are significant in the application of APT in TSE from 1991 to 201٦.3) To provide a comprehensive analysis on combine variables concurrently that will integrate all fragmented studies being done previously on Tehran stock exchange. The paper is organized as follows: Section two summarizes the evidence on APT; Section three explains the data and method; Section four presents the findings; and Section five concludes the paper.

2. Literature Review

There are rare studies related to testing APT by using combine variables. However, Chen and Hsieh (1985) examine the impact of firm size on bond rate of return for the period of 1958-1977 in a construction of a multi-factor pricing model. They consider that for studying this relation, they must believe some of macroeconomic that influenced prospect cash flow and therefore stock return. As the changes of bond yields are reproduced in bond returns, the sensitivity of a stock's return to the changing risk premium is estimated by regressing the stock's returns on the bond return variations. After placing the portfolios in relation to firm size to test the firm size effect, they employ a variant of the Fama-MacBeth (1973) method. To measure the variables' betas they first regress each of the 20 portfolios on the macro variables in the first five years. Afterward in the sixth year for the twenty intervals they carry out cross-sectional regressions of the twenty portfolios' returns on the obtained portfolios' multiple betas month-by-month. In general, on account of the evidence collected up to now, they came to the conclusion that the firm size irregularity is fundamentally captured by a multi-factor pricing model and by the additional risks borne in an efficient market the higher average returns of smaller companies are vindicated.

He and Ng (1994) combine the five Chen, Roll and Rose (1986) macro variables, the two significant firm-specific variables found in FF and the market index in their pricing model. They found that when the firm-specific variables are included in the model the cross-sectional variation of average stock returns is not described by either the market index or the macro variables. These consequences increase severe worries about the helpfulness of the CAPM in describing security returns. On the contrary, Jegadeesh (1992, p….) found that "the size effect cannot be explained by betas and a search for risk-based explanations should consider the effects of non-market risk factors", such as those employed by Chan, Chen, and Hsieh (1985).

Chen and Hsieh (1998), examines the cross-sectional variation in equity real estate investment trusts (EREITs) returns. A pooled cross-sectional, time-series approach concerned as an alternative to the two-step Fama-MacBeth regression. In this research, they combine macro-economic variables that Chen, Roll and Rose (1986), employed in their research with two accounting variables that are size and book-to-market variables. The research uses a single pooled cross-sectional time-series regression approach to investigate EREITs pricing. The results show that the size factor commands a risk premium in EREIT pricing. Beta does not describe return variation. Size is the only consistent factor describing prices. When size and book-to-market variables are incorporated in the model, none of the variables of Chen, Roll and Ross (1986) is significant. Just the unexpected changes in term structure is significant in versions of the model eliminate firm-specific variables.

Aleati and Gottardo (2000) explored economic variables and examined pricing outcomes as systematic risks employing Italian data. They expanded the set of economic variables examined in preceding national and international research to contain both economy-wide factors and equity derived factors, like those considered in Fama and French (1993) for the US market.. Their results exposed that the economic risk premium cooperated with the size and book-to-market equity variables are priced even along with macroeconomic factors. Results for the Italian market make known that both macroeconomic variables and equity risk factors relateto pricing stock returns. This is not unexpected for an open economy like the Italian one, but the study offer evidence that changes considerably from the famous consequences for the US stock market.

To test the arbitrage-based theory, Mohseni (2007) employed a two-stage procedure which is named "Fama-Macbeth" in Tehran stock exchange. In this study the determination of the factor scores, time and premium risks and rewards of using the two methods are described.

Heidari and et.al, (2009) examined the relationship between the rate of expected return and systematic risk of four major economic asset classes, including real estate, gold, stocks and currencies in Iran from 1995 to 2007 by applying arbitrage pricing theory. The results indicated that in some Iranian economy's financial assets such as exchange rate and stock market, accepting higher risk does not show higher expected returns. While this result does not carry out the same outcome for real state and gold markets.

Sabetfar and et.al, (2011) provided weak evidence in support for the application of Arbitrage Pricing Theory (APT) on the Iranian stock market in the Sharia (the sacred law of Islam faith)is based on the close economy for the period 1991-2008. Tests conducted using the principal component analysis and canonical correlation model showed that at least one to three factors that can explain the cross-section of expected returns in this market. Financial and economical sanctions possibly explain the negative stock market returns which show the reaction of investors to the announcement of sanctions

(Sabetfar and et.al, 2013). This study examines empirically the factor analysis model of stock returns using Iranian data over the period of 1991-2010. Specifically, it examines whether the behavior of stock prices, in relation to financial ratio reflects the behavior of earnings. Our findings show a significant relationship between some accounting ratio and expected stock returns in the Iranian market.

Therefore, this paper reflects a comprehensive study on the effectiveness of variables on the risk factors of Iranian stock market. It covers more than 23 years of the stock market activation. This study has been achieved through a longer period and applied in more range of variables in comparison with other studies.

3. Methodology

The analysis period in this study includes 23 years from 20th March 1991 to 19th March in 2017. In Iran this is considerably the most update period and longest used for any research on the APT. The time period studied covers the most recent data available at the beginning of this study. A sample of statistical population out of the total firms listed in TSE will be designated on the basis of the succeeding criteria: First, the fiscal year of the firms should have ended at March 19; second, the stock of the firms should have been traded in the period of study. Those stocks, which are not traded for more than four consecutive months, are excluded.

For implementation factor analysis, there must be no missing data for the entire period under evaluation since computation of correlation needs concurrent observations. This is the cause for imposing a selection

criterion that a selected stock must be listed and constantly traded for the entire period. This selection criterion sets up a survivorship bias and these trends to the excluded factors may be unusual to failed firms. Also, it is preferable to have number of stocks. Due to the availability of smaller stocks on the main board of the TSE in the earlier years, the number of stocks in the sample was consequently limited. The stocks chosen in this research are taken randomly from Main Board of Tehran Stock Exchange Market (TSE). Nevertheless, there are 80 stocks chosen, 20 stocks were removed because of the missing observations during the study period. Thus, full data considered from 20th March 1991 to 19th March 201٦ which has 60 stocks in the sample.

Also, factor analysis needs the returns to be multivariate normal. Nevertheless, the postulation of multivariate normality cannot be simply tested, since it is impractical to test an infinite number of linear combinations of variables for normality. It is easier to test for univariate normality, though this is an essential but not adequate condition of multivariate normality. The kolmogorof-Smirnof test may be employed. Stocks which are not univariate normal are also maintained for successive analysis to decrease the number of stocks available. Such consequences must be interpreted with caution.

Stock Return (R_{it}): Taking into account the effect of capital increase, stock split and dividends, the stock return will be calculated with the following formula:

$$R_{it} = P_t - P_{t-1} / P_{t-1} \quad (1)$$

Where,

R_{it} : the return of a stock in Period t.

P_t : stock price in period t.

P_{t-1} : stock price in period t-1.

The stock price data for this study are the yearly returns on stocks on the main board of the TSE. This price data is adjusted for capital increases, stock splits, and dividends. The modifications made for stock splits, capital increases and stock dividends avoid likely deformations on return data

All the tests are carried out on individual security returns rather than on returns of groups of securities, as is frequently done in the empirical asset pricing literature. This study choices this option by the small number of listed securities which distinguishes the Tehran Stock Market. In the sample period, this number ranged 80, but the number of stocks with complete time series returns is even smaller. If we work with well-diversified portfolios, the resulting number of assets would not have been adequate to get reliable factor risk premium estimates. Nonetheless, there is a more significant deliberation on this issue. Some experiments are of interest as it generates evidence which is not issue to the possible spurious outcome and would come out from an arbitrary selection of securities to be contained in a given portfolio: a matter first made a long time ago in Roll's critique (1977), and which was specially tackle in the interesting analysis by Lo and MacKinlay (1990).

3.1. Selection of Macroeconomic variables

An attempt is made to examine more macroeconomic variables by the researcher than those found significant in Chen, Roll and Rose (1986) and Mohseni (2007)**.** Chen *et al.* (1986) found their choice of macroeconomic variables on the simple instinct that the value of a financial asset is equal to the sum of its discounted expected future cash flows. Any economic occurrence that thoroughly affects either the expected cash flows or the discount rate will have an outcome on prices and expected returns. These extra variables contain real money supply (M_1, M_2), trade balance, currency exchange rate (US $), real Gross Domestic Product (GDP), central bank reserve and Tehran Price Index (TEPIX). As recommended by Chen, Roll and Ross (1986), the choice of applicable macroeconomic variables needs decision and the study draw upon both on existing theory and existing empirical evidence. Thus, the study comprises a variety of macroeconomic and financial factors that are proxy for the stock market. Some of these factors possibly have highly correlation and perhaps dropped in the last model. Most pertinent of other factors that are thought in the Iranian setting are added to this study. The variables which are chosen are the unexpected changes in inflation (which will be considered employing the Consumer Price Index), oil price, production of crude oil, export of the crude oil, ROE of banks (proxy for interest rate), Central Bank reserves, and volume of stock transaction of TSE.

Data on consumer price index and trade balance (export minus import) are getting from the monthly Statistical bulletin of the Department of Statistics of Iran. The value models are employed. The ROE of banks as proxy for interest rate are obtained from

monthly bulletin of CBI and IFS. The figures on Gross Domestic product, Money supply (M_1, M_2), Rials / US$ exchange rate also obtained from same monthly bulletins.

Figures on crude oil prices, production of crude oil, and export of crude oil are obtained from monthly OPEC bulletins. Volumes of stock transaction of TSE, Tehran price index (TEPIX) are obtained from TSE publications.

3.2. Selection of Accounting Variables

One of the aims of this study is to examine the helpfulness of financial (accounting) variables in assessment of returns and risk of Iranian firms in TSE. On the other hand, for each firm under the study data on necessary accounting figures are collected from the database of financial statements and balance sheets of the TSE firms published on the official website of the TSE. Data on yearly accounting variables are obtained from databases preserved by the TSE.

Several firm specific accounting figures are required for the analysis to carry out in this study. These figures contain data from individual firms' balance sheets [Size, Price-to- Earning ratio, Book- to-Market ratio, financial leverage, Operating leverage, sale-to-price ratio, Return on equity (ROE) and Return on Asset (ROA)] as will be detected in the annual financial statements reported to the TSE. For the measurement period that begins at March 20th of year *t+1*, data listed above are achieved from the annual financial statements of year *t*. Market value of equity is estimated as the number of shares outstanding times the stock price as the commence of the return measurement period, i.e. March 20th. Necessary accounting data span a period from 20th March 1991 to 19th March 201٦.

Three criteria are practical in stock selection. First, a stock should not have negative book equity at the fiscal year-end that falls in year *t*-1 (Fama and French, 1995). Second, to render activity in trading of the stocks, any stock without a trading record for more than four consecutive months during the twelve-month period preceding March of year *t* is disregarded (Chui and Wei, 1998).

3.3. Combine Variables

In this study, the examination is carried out by employing yearly data for the period spans from 20th march 1991 to 19th march 201٦. The data in this section contain combined two sub-groups: First, data set contain firm specific data. Second, data set contain macroeconomic factors. In this section, the study connects these two sets and examines APT.

Table 1. Abbreviation and definition of the 15 combine variables

Combine Variables	Definition	Symbol
MACROECONOMIC VARIABLES		
Consumer Price Index	First difference of natural logarithm	CPI
Money Supply (M_2)	First difference of natural logarithm	M1&M2
Exchange Rate (Rial / US$)	First difference of natural logarithm	ER
Tehran Price Index	First difference of natural logarithm	TEPIX
Oil Price	First difference of natural logarithm	OP
Export of crude oil	First difference of natural logarithm	ECO
Gross Domestic Product	First difference of natural logarithm	GDP
Interest Rate	First difference of natural logarithm	IR
ACCOUNTING VARIABLES		
Size (Market Capitalization)	$MVE_{i,t} = (P_{i,t+1}) x (NSO_{i,t+1})$	SIZE
Price - to- Earning ratio	Market price of common stock / Diluted earnings per share of common stock	P/E
Book- to- Market ratio	$BMR_{i,t} = TE_{i,t} / MVE_{i,t}$	B/M
Operating leverage	% Changes in EBIT / % Changes in sales	DOL
Financial leverage	Total debt	FL

Combine Variables	Definition	Symbol
	FL = ---------- Shareholders equity	
Return on equity	Net income ROE = ---------- Average owner's equity	ROE
Return on Asset	Net income ROA =---------- Total Assets	ROA

3.4. Research Design

This study is designed to identify the impact of several factors, including macroeconomic and accounting factors, using 15 factors. This research employs Chen, Roll and Rose (1986) method to study the empirical applicability of the APT. In this subsection, the procedure to test the APT is as follows: First, for testing the CVM models of the APT, the Factor analysis with Principal Component Analysis (PCA) will be used to determine the number and loadings of the factors. Use individual security factor loading estimates from principal component analysis to explain the cross-sectional variation of individual estimated returns. Secondly, cross- sectional generalized least square regression analysis test is performed to determine the number of priced factors to measure the size and statistical significant of risk premia associated with the estimated factors from the common factors extracted in the first stage. Factor analysis with Principal Component Analysis (PCA) is a simpler and more elegant method as compared traditional maximum likelihood factor analysis. Furthermore, studies such as Mei (1993) have reported that the principal component factors generally explain the variation of stock returns a little better than traditional factor in the first stage; the principal component factor analysis procedure will describe the return in the following way:

$$R_{it} = b_{i1}PC_1 + b_{i2}PC_2 + b_{i3}PC_3 + \ldots + b_{ik}PC_k + ei_t \quad (9)$$

Where,

R_{it} = is the individual security returns;

b_{ik} = is known as factor loadings, which can be used to represent the sensitivity of the security again or against the asset i's returns to the movements in the common factors;

PC_k = is the principal component scores of asset analysis. Factor analysis with PCA method will be carry out on sixty individual securities during twenty years.

Thirdly, the Canonical Correlation Analysis is used for the relationship between stock market returns and combin variables. Interpretation of the two significant canonical variates from loading are based on 0.3000 and above of canonical variates. Both the direction of correlation in the loadings matrices and the direction of scales of measurements are considered when interpreting the canonical variates (Tabachnik and Fidell, 1996). The first canonical variate formed the stock market returns are the most successful linear combination of the security to predict the first canonical variate formed from the macroeconomic variables

To test general hypothesis in this study, identifying *b's* are priced in the arbitrage pricing relationship. Thus, in this study, the *b's* will be used to test the pricing of risky factors. This traditional test using the APT is usually undertaken by implementing a two cross-sectional GLS regression procedure used in Black, Jensen and Scholes (1972) and Fama and MacBeth (1973) method. The APT implies that if K factors are responsible for driving the individual asset returns time, then there should be a risk premium attached to each of these factors. In the following way:

$$E(R_{it}) = \lambda_0 + \Sigma^{k}_{k=1} \lambda_k b_{ik}$$

The 15 variables were grouped as factors using factor analysis. Table 1 lists abbreviation and definition of 15 factors. If APT is valid, at least one number of priced factors is statistically significant. This study used the p- values to determine the significance of the individual risk premia. Roll and Rose (1980), and Dhrymes *et al.* (1984) have shown that a more efficient procedure is to employ the factor loadings to perfume a natural GLS cross-sectional regression which yields unbiased estimates of the risk premia. Gibbons (1982), stated that despite the

fundamental role played by the two-pass method in modern asset-pricing empirical work, not much is known about its statistical properties. Since the independent variable in the cross-sectional regression is measured with error, the second-pass estimator is subject to an errors-in-variables (EIV) problem, rendering it biased in small samples.

Also, three econometrics problems need to be addressed before running the final model: Multicolliniarity problem, Autocorrelation problem and Hetrodasticity problem. Multicolliniarity problem is needed to be solved before running the final model. There are large numbers of macro-economic explanatory variables identified in which some variables may be closely related. To minimize this problem, factor analysis was used to reduce the number of explanatory variables with maximum Eigen value.

4. Results

4.1. Descriptive Statistics of Security Returns

Table 2 summarized the descriptive statistics for full period. Sixty Individual securities are considered for the period. According to this table all the stock returns have positive mean excess returns. All the variables are volatile in the period with regard to the standard deviation of stock returns. However, Kolmogorov-Smirnov and Shapiro-Wilks tests show that all the stocks returns are normally distributed.

Table 2. Summary of Descriptive Statistics - Security Returns

	Full Period 60 IS
Mean	39.35
Standard Deviation	42.80
Kolmogorov-Smirnov	.000*
Shapiro-Wilk	.000*

Note: IS: Individual Securities.
Full Period: 1991-2016
*: Normality significant at 1 percent level.

4.2. Descriptive Statistics of Macroeconomic Variables

In this section discussions of the descriptive statistics of macroeconomic and accounting variables are reported. Table 3 shows the descriptive test for the period. The outcome represents that the average rate of mean of the macroeconomic variables were higher from accounting variables. It is also perceived that the standard deviation for most of the macroeconomic variables were higher for accounting variables too. This study finds that most of macroeconomic variables were more volatile than accounting variables. The higher volatile of macroeconomic variables is due to the effect of 1997 financial crisis and tightening of sanctions in the last years. As the result shows, for normality test all the variables are also normally distributed.

Table 3. Summary of Descriptive Statistics - Macroeconomic and Accounting Variables

Macroeconomic and Accounting Variables	**Full Period**	
	Mean	**St.dv**
Consumer Price Index (Index Number)	81.22	59.39
Exchange Rate (National Currency per US Dollar)	5697.7	4215.91
Money Supply (M2) (Billions Rials)	413125.42	48122. 22
Oil Price (Million Rials)	248832.38	342991.016
Tehran Price Index (TEPIX) (Millions Rials)	3667.8826	٤٠38.٦١٢
Export of Crude Oil (Thousand barrels per day)	4460.5532	234.09498
Interest rate (percent)	17	15.20
GDP (Billions Rials)	9.9211	8860.5

Macroeconomic and Accounting Variables	Full Period	
	Mean	St.dv
Size (Market Capitalization)		22.8635
Price - to- Earning ratio	7. 30	7.71
Book- to- Market ratio	3.88	3.19
Operating leverage	53761.52	29618.00
Financial leverage	3.0941	.96520
Return on equity	12.69	7.98
Return on Asset	122.7523	70.65

4.3. Factor Analysis

The initial results from factor analysis show that four out of the 15 combine variables. Table 4 shows the KMO and Barlett's Test results. The Kaiser-Meyer-Olkin test (KMO) value was 0.61 and the Bartlett's test of sphericity was significant at above the 99 percent acceptance level indicating the appropriateness of principal components factor analysis for this data set. The analysis identified 4 factors based on the identification criterion that the eigen value for factor selection must exceed 1. The sixty individual securities explained 87 percent of variance in returns. In addition, the first factor has perfect generalizability that disappears quickly from the second factors onwards (Kryzanowski & To 1983).These findings are consistent with findings in other markets and study: e.g. a UK study, Sabefar et.al,(2011), Garrett and Priestley (1997) using 80 stocks identified 20 factors that explained a majority of the return variance in that market.

Component one consist the first seven macro-economic variables, which are sensitive to the fluctuation in economy of Iran. The variables are Consumer price Index, Exchange rate, Supply of money, Oil price, TEPIX, GDP. The first component can be named macro-Economic factor. The second component consists of the next four accounting ratios that show sensitive to variables and financial statement. Therefore, the variables are Size, Price to earning ratio, Operation and financial leverage. The third component includes two accounting factors which are sensitive to financial statement too. The third factor includes ROA and ROE. The last component consists of the macro-Economic and accounting factor. These factors include Book to Market ratio and Interest rate. Table 5 summarizes the four risk factors obtained from a series of fifteen combine variables.

Table 4. KMO and Barlett's Test

Kaiser-Meyer-Olkin Measuring of sampling Adequancy	Barlett's Test Sphericity		
	Approx.Chi.Square	Df.	Sig
50.6	589.853	105	0.000

Table 5. Results on the factor analysis and the four risk factors extracted from the 15 combine variables. Rotated Component Matrix

Combine Variables	Component			
	1	2	3	4
CPI	8.98			
ER	0.985			
Oil Price	0.983			
M2	0.981			
TEPIX	0.828			
ECO	0.736			
GDP	0.885			
IR				0.930
SIZE		0.910		
P/E				0.569
B/M		0.726		
DOL		0.769		
FL		.760		
ROA			0.789	
ROE			.355	

Component1: Macro-Economic Factor
Component2: Accounting Factor
Component3: Accounting Factor
Component4: Macro-Economic and Accounting Factor

4.4. Regression of average returns against factor scores coefficients

To test the model, cross-section regression of the means stock market for the 19- year period was performed against the 4 factor loadings. The results indicated that the 2 factors are jointly significant as evidence by F-value of 89.41 which is well above the acceptance level of 0.040 (Table 6). The t- values ranged from 4.1 to 0.3 which are all above the critical value for five percent level of significant for the sample. The adjusted R- squared value was good at 0.63.

Table 6. Cross-Sectional Regression of average returns against factor scores coefficients

	60 Individual Securities
No. of the Priced Factors	2
λ1 λ2	0.001 (3.44)*** 0.0222 (2.20)*
F	46.85
Sig.F	0.04**
Adj-R Square	0.62

Note: N=No. of Factors from factor analysis. t- Values in bracket.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level. Only priced factors at 1%, 5% and 10% significant level are shown.

Based on the results, the first factor is factor ۲ which is the most important risk factor for the returns of TSE. Therefore, the most significant factors are accounting variables in the period. The most important factor is size. With numerous empirical findings on ordinary common stocks, *size* is found significantly priced among TSE's stock over time.

The second risk factor is factor 4 in Table 3. Therefore, another important risk factor is Macro-Economic and Accounting factor. The interest rate and *B*/*M* ratio, however, are significant in either of the model. Based on the test results, the macro variables are generally insignificant in the pricing. The only exception is the unanticipated change in the term structure of interest rate. Nonetheless, the finding here is in line with He and Ng (1994) and Chen and Hsieh (1998) in that none of the macro variables are significant in explaining the cross-sectional variation of common stock returns when the two firm specific variables are also included in the model.

Findings for Canonical Correlation Analysis summarized in Table 7. It demonstrates that, the factor structure of the Iranian economy in the period is the interest rate. However, these results are not supported in the Standardized Variance of the Principal Component Scores of Macroeconomic Variables when accounting variables are in the model (Tables 7).

Table 7.Canonical Correlation Analysis

Principal Component Scores of the Stock Market Returns	Interest rate
Shared Variance	28%
Redundancy	1.75%
Principal Component Scores of the Macroeconomic and Accounting Variables	Interest rate Size
Shared Variance	72%
Redundency	4.6%

Shared Variance is Standardized Variance of the Principal Component Scores of Stock Market Returns Explained by their Own Canonical Variate is ۲۷%. Redundancy is Standardized Variance of the Principal Component Scores of Stock Market Returns explained by the Opposite Canonical Variate which is 4.٦%.

5. Discusion and Conclusions

The time period chosen for this study aims to test the empirical applicability as wide as possible time frame. Sixty stocks are available for the testing period 1991-201٦. The results show that strong validity applicability of APT in Iran over the study period. This can be seen in the results of the factor analysis which generally found one to four factors being priced over the period. The results suggest that maximum 87% of variance was explained by the factors. The 13% of variance is remained without any explanation. This research found out that the 15 variables were used and explained the excess returns of the samples and all of them were not affected stock market returns. With numerous empirical findings on ordinary common stocks, SIZE is found significantly priced among TSE's stock over time. The interest rate and B/M ratio, however, are significant in either of the model. Based on the test results, the macro variables are generally insignificant in the pricing. The only exception is the unanticipated change in term structure of interest rate.

With pooling, more powerful tests can be obtained from the limited sample of TSE available. Beta does not explain return variation. Size is the sole consistent factor explaining prices. None of the variables of Chen, Roll and Ross (1986) is significant when size and book-to-market variables are included in the model. CCA indicates that size and interest rate explain maximum 28% of variance.

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