

Explaining the Stock Return Via a Macroeconomic Multifactor Model

*Khaled A.Al-Zubi and Hussain Salameh **

ABSTRACT

This paper investigated the relationship between economic variables and stock returns in the industrial sector in Jordan. The study is conducted at monthly intervals over the six-and-half years period from July 1997 to 2003 using a value weighted average returns. Four variables were examined; Industrial production, expected inflation, unanticipated inflation and term structure. The evidence suggested that only two variables do really affect the stock return when considering the returns without its dividends, which are the expected inflation and the unanticipated inflation; while only one variable affects the stock returns when taking the dividends into consideration; this is the unanticipated inflation.

In addition, this study examined if there is a long-run relationship or a short-run relationship between the unanticipated inflation and stock returns. The results showed that there is a long-run relationship between the two variables but there is no short-run relationship between them.

Keywords: Jordanian Capital Market; Macroeconomic Variables.

1. INTRODUCTION

A dynamic capital market is an important segment of the financial system of any country as it plays a significant role in mobilizing savings and channeling them for productive purposes. The efficient fund allocation depends on the stock market efficiency in pricing the different securities trade. The modern financial theory focuses upon factors such as sources of risk, and it contemplates that the long-run return on individual assets much reflects the changes in such factors (Roa and Radjeswari, 2000). Different models specify these factors. Some of these models are in the micro level and others are in the macro level.

At the micro level, The Capital Asset Pricing Model (CAPM) of Sharp (1964), Linter (1965) and Black (1972)

(SLB) has long shaped the way academicians and practitioners think about average returns and risk. The central prediction of the model is that the market portfolio of invested wealth is a mean variance efficient in the sense of Markowitz (1959). The efficiency of the market portfolio implies that: (a) expected returns on securities are a positive linear function of their market β s (the slope in the regression of a security's return on the market's return), and (b) market β s suffices to describe the cross-section of expected returns (Fama and French, 1992).

At the macro level, Roll in 1977 argued that the Capital Asset Pricing Model (CAPM) should be discarded because it was practically impossible to verify its single economic prediction. At the same time, Ross developed the arbitrage pricing theory (Multi-factor pricing model) which implies that the expected return on an asset is a linear function of factor risk premiums and their associated factor sensitivities (Haugen, 1997).

The macro variables investigated in the empirical

Received on 22/3/2006 and Accepted for Publication on 14/1/2007.

literature include the inflation rate, aggregate output, unemployment rate, term and default spreads on bonds and industrial production (Rapach, Woher and Rangvid, 2003). Chen, Ross and Roll (1986) specified four macroeconomic risk factors: industrial production, term structure, default risk and unanticipated inflation which have considerable ability to explain the security returns.

Some studies found evidence that stock returns are predictable using macro variables, others failed to find much support at all for the ability of certain macro variables to predict returns. Some studies found strong evidence of the predictive ability for a given variable, while others found no evidence for the same variable. The mixed results make it difficult to determine which particular macro variables (if any) are reliable.

There is a lack of consensus about the number and the identity of the factors that can affect the return. This study investigated if the four factors of the Chen - Roll - Ross model in the macro level may affect the return of a portfolio of the industrial sector in Amman Stock Exchange (ASE).

The objective of this paper is to specify a model that may predict the stock return in the industrial companies sector in Amman Stock Exchange by applying the four factors of the Chen-Roll-Ross model at the macro level. Another objective is to specify if there is a long or short relationship between the unanticipated inflation and stock return. In addition, it aims to find out if the models employed in the developed markets applicable to explain the cross sectional variations on stock return at the industrial sector in Amman Stock Exchange.

We used Generalized Methods of Moments (GMM) to regress the main models, and used Augmented Dickey-Filler (ADF) test and Phillips Perron (PP) test to check the unit root of the series. Also, we applied the Johansen Co-integration test to check the long-run relation and the Granger Causality to check the short-run relation.

The results showed that the Chen, Ross and Roll (CRR) model explains nothing of the variation in stock return. However, the only variable in the CRR model that affects the stock return is the unanticipated inflation. It showed also that there is a long relationship between the market return and the unanticipated inflation, but there is no short run

relationship between the two.

This paper is organized as follows: Section two explores a theoretical background concerning the pricing models, and surveys main results of the previous studies. Section three outlines the methodology and data description. Section four shows the empirical results of this study and, finally, Section five outlines the conclusion that provides an overview of the results of the study and the recommendations.

2. BACKGROUNDS AND LITERATURE REVIEW

The determinants of the stock return have received considerable attention in the asset pricing literature, and many attempts have been made to find out the best asset pricing model. To explore this issue, a background about the capital markets in Jordan is highlighted in the first section, a theoretical background of the main asset pricing models to explain the variations on stock return is highlighted in the second section, a survey of the previous studies that have been done on this issue is highlighted in the third section.

The Capital Markets in Jordan

Capital markets play an important role in mobilizing savings through encouraging investment in securities and channeling savings to serve the interests of the national economy. In Jordan, an unorganized securities market started trading in shares from the early thirties, while trading in bonds started in sixties. The government set up a market to regulate, issue, and deal with securities in 1978, which is known as Amman Financial Market (AFM). However, this market has a dual task: the role of Security and Exchange Commission and of Traditional Stock Exchange. In 1997, to complete the Jordan capital market infrastructure in compliance with international standards, a restructure process has been made by separation of the supervisory and legislative role from the executive role of the capital market. The result was three institutions: Amman Stock Exchange ASE (www.ase.com.jo) and the Securities Depository Center SDC (www.sdc.com.jo), which played the executive role, while the Jordan Securities Commission (JSC) (www.jsc.gov.jo) was entrusted with the supervisory and legislative role.

Background

A fundamental principle of finance is the tradeoff between risk and return. One portfolio can be expected to outperform another only if it is riskier in an appropriate sense. There are two theories that provide a rigorous foundation for computing the tradeoff between risk and return:

1. The Capital Asset Pricing Model (CAPM).
2. The Arbitrage Pricing Theory (APT).

Both the CAPM and the APT agree on that many different firm-specific forces influence the return on any individual stock. According to the CAPM, systemic risk depends only upon exposure to the overall market, and it is usually represented by a broad stock market index. This exposure is measured by the CAPM beta. Other things equal a beta greater (or less) than 1.0, which indicates greater (or less) risk relative to swings in the market index. (Burmeister, Roll and Ross, 2003).

The APT takes the view that there need not be any single way to measure systemic risk. While the APT is completely general and does not specify exactly what the systemic risks are, or even how many such risks exist, academic and commercial research suggests that there are several sources of risk which consistently impact stock returns. These risks arise from unanticipated changes in the following fundamental economic variables: investor confidence, interest rates, inflation, real business activity and market index. Every stock and portfolio has exposures (or betas) with respect to each of these systemic risks. The pattern of economic betas for a stock or portfolio is called its risk exposure profile. Risk exposures are rewarded in the market with additional expected return, and thus, the risk exposure profile determines the volatility and performance of a well-diversified portfolio. The profile indicates how a stock or portfolio will perform under different economic conditions. (Burmeister, Roll and Ross, 2003).

The index model's decomposition of returns into systemic and firm-specific components is compelling, but confining systemic risk to a single factor is not. Indeed, the systemic or macro factor summarized by the market return arises from a number of sources, for example, uncertainty about the business cycle, interest rate and inflation. It stands

to reason that a more explicit representation of systemic risk, allowing for the possibility that different stocks exhibit different sensitivities to its various components, would estimate a useful refinement of the index model (Bodie, Kane and Marcus, 2002).

Numerous empirical studies have investigated the productivity of stock return using macroeconomic variables. This is not surprising, as the macro variables likely exert important influences on firms' expected cash flows, as well as the rate at which these cash flows are discounted. More formally, insofar as macro variables affect future investment opportunities and consumption, they are key variables in inter-temporal asset pricing models and can represent priced factor in Arbitrage Pricing theory (Rapach, Woher and Rangvid, 2003).

Stephen Ross (1977) has proposed an approach called the APT which includes any number of risk factors, so the required rate of return could be a function of two, three, four, or more factors. These factors can specify the equilibrium risk/return relationship, but a multifactor APT model is more difficult and expensive to use. The general approach is to attempt to find economic series. Important work on the identification of economic surrogates for factors has been and is being conducted. Empirical research in this area consists of; first, carrying out the factors analysis, and then searching for economic series that are highly correlated with individual factors. In a widely cited study, Chen, Roll and Ross (1986) found four factors that are highly correlated with the following economic variables:

- 1- Industrial Production or the return on the market portfolio.
- 2- Changes in the risk premium indicated by the difference between Aaa and Baa corporate bonds.
- 3-The slope of the yield curve represented by differences between yields to maturity on long-term and short-term government bonds.
- 4- Unanticipated inflation. (Seitz and Ellison, 1999).

Bodie, Kane and Marcus (2002) mentioned in their book also that one of the examples of the multifactor approach is the work of Chen, Roll and Ross (1986), who used the following set of factors to paint a broad picture of the macro economy. Their set is, obviously, only one of many possible

sets that might be considered:

- Percentage change in industrial production.
- Percentage change in expected inflation.
- Percentage change in unanticipated inflation.
- Excess return of long-term corporate bonds over long-term government bonds.
- Excess return of long-term government bonds over T-bills.

When forming those independent variables with stock return as a dependent variable into an equation, they got a multidimensional security characteristic line with five factors.

Burmeister and McElroy (1987) continued developing a multi-index model building on the work of Chen, Ross and Roll. They discovered five indices: default risk, time premium, deflation, change in expected sales and the market return not captured by the previous four variables (Elton and Gruber, 1995).

Brothers used seven variables to explain the return on securities: economic growth, business cycle, long-term interest rates, short-term interest rates, inflation shock, US dollar exchange rate and the residual part of the market that is uncorrelated to the previous six variables (Elton and Gruber, 1995).

Merton (1973) developed a multifactor CAPM (also called the Inter-temporal CAPM or ICAPM). He suggested a list of possible common sources of uncertainty that might affect the expected security returns. Among these are uncertainties in labor income, prices of important consumption goods (e.g., energy prices), or changes in future investment (e.g., changes in the riskness of various asset classes) (Bodie, Kane and Marcus, 2002).

An alternative approach (micro) for specifying macroeconomic factors, as candidates for relevant sources of systemic risk, uses firm characteristics that seem, on empirical grounds, to represent exposure to systemic risk. One such multifactor model (three-factor model) was proposed by Fama and French (Bodie, Kane and Marcus, 2002).

In this model, the market index does play a role and is expected to capture systemic risk originated from macroeconomic factors. The two firm characteristic

variables are chosen because of longstanding observations that corporate the fact that capitalization (firm size) and book-to-market ratio seem to be predictive of average stock returns, and hence risk premiums. Fama and French propose this model on empirical grounds, while size and book-to-market are not obvious candidates for relevant risk factors, these variables may be proxy for yet unknown more fundamental variables. For example, Fama and French pointed out that those firms with high ratios of book-to-market values are more likely to be in financial distress, while the small firms may be more sensitive to changes in business conditions. Thus, these variables may capture sensitivity to risk factors in the macro economy (Bodie, Kane and Marcus, 2002).

Inflation

The relationship between inflation and common stock return has been extensively studied. Many studies analyze the reaction of the stock return to the announcement of the CPI inflation rate. If the unexpected inflation is bad news for the stock market, and if the announcement of the CPI contains new information about inflation, then the unexpected inflation (deflation) should be associated with a decrease (increase) in stock prices at the time of the announcement. There is a lag of period between the time that collects the price data and the time when the CPI is announced (Schwert, 1981).

The Fisher effect suggests that interest rates in any country will adjust to inflation so that the real rate (the increase in buying power) remains constant (Seitz and Ellison, 1999). Economic theorists have long considered common stocks (risky assets) inflation hedge because stocks represent ownership of physical capital whose real value is assumed to be independent from the rate of inflation. This independence implies that change in the rate of inflation should be accompanied by an equal change in the nominal rate of return: a positive correlation between the nominal rate of return on equity and the rate of inflation. Empirical literatures reported that common stocks in the United States have poor hedges against inflation, not only against expected inflation, but also against unexpected inflation (Rweidan, 2005).

Fama attempted to explain the negative relationship between stock returns and inflation through a hypothesized chain of macroeconomic linkages that have their basis in the money-demand theory and the quantity theory of money. Fama's hypothesis predicts that rising inflation rates reduce real economic activity and demand for money. A reduction in economic activity negatively affects the future corporate profits and stock prices. The resulting negative relationship between the stock returns and inflation is referred to as the "proxy effect", in sense that it reflects the detrimental consequence of inflation on real economic activity. According to Fama, the statistical relationship between inflation and stock returns should disappear once the effect of real output growth is controlled (Al-Khazali, 2000).

Kaul and Seyhun have offered another version of the proxy-effect hypothesis. They contend that the negative stock return-inflation relationship is a combined effect of a negative relationship between inflation variability and stock returns and, at the same time, a positive relationship between inflation variability and inflation rate. They claim that inflation serves as a proxy for inflation variability in the stock-inflation relationship (Al-Khazali, 2000).

The evidence that stock prices are affected by the unexpected inflation seemed puzzling, given that stocks are claims on income generated by real assets. But the unexpected inflation indicates an economic shock; therefore, its effect depends on its source. Aggregate demand shocks should create positive correlation between resulting unexpected inflation and stock prices, whereas aggregate supply shocks should create negative correlation (Amihud, 1996).

Modigliani and Cohn suggested an explanation of the negative effect of the unexpected inflation on stock prices. Unexpected inflation raises nominal interest rates and if investors use the higher rates to discount future earnings, ignoring by that the positive effect of inflation on nominal earnings, the result is an erroneous under-valuation of stocks (Amihud, 1996).

Industrial Production: Changes in industrial production affect the opportunities facing investors and the real value of cash flows (Elton and Gruber, 1995).

As a proxy for long-run growth trends in the economy,

Burmeister and McElroy used year-to-year changes in total industrial production. This series provides a gauge of general economic well being (Elton and Gruber, 1995).

The Term Structure: Differences between the rate on bonds with a long maturity and a short maturity affect the value of payments far in the future in relation to near-term payments (Elton and Gruber, 1995).

Burmeister and McElroy found that if the premium for holding longer maturity instruments is high, the rate of return required by the market should also be high and stock return should be high. Accordingly, the sign of the coefficient of term structure variable should be positive (Elton and Gruber, 1995).

Literature Review

For the last two decades, there has been much research in the determinants of stock prices. Much of this research has been generated by an apparent failure of the established asset pricing model, the Capital Asset Pricing Model (CAPM), in explaining security returns adequately (Lambrick 2005). Here below are sequence narrations of these articles.

Roa and Radjeswari (2000) incorporated a big number of macro variables. The factors that influence the returns of assets are industrial production, agricultural production, money supply, interest rate, exchange reserves and inflation.

Flannery and Protopapadakis (2001) seek to identify macroeconomic risk factors candidates by simultaneously examining the impact of macro economic announcements on the level and conditional volatility of daily equity return. Depending on seventeen macro series announcements, they found six candidates for price factors: three nominal (CPI, PPI and a Money Aggregate) and three real (The Balance Trade, The Employment Report and Housing Starts).

Rapach, Wohar and Rangvid (2003) examined the predictability of the stock return using macroeconomic variables in twelve industrial countries. Interest rate is the most consistent predictor of stock return across countries. Burmeister, Roll and Ross (2003) suggested several primary resources of risk which impact the stock return.

In his paper, Lambrick (2005) investigated the relationship between economic variables and stock market returns in Australia. Sixteen variables were examined falling

in five categories: real, monetary/finance and external variables in addition to a price level variable and a labor market variable. The results were two and possibly four variables which decide the prices in the stock market over the study period. (The two variables are the US\$ exchange rate and the composite leading indicator while the retail sales and industrial production are only for the entire period of the study).

Schwert (1981) analyzed the reaction of stock prices to the new information about inflation. It seems that the stock market reacts negatively to the announcement of unexpected inflation in the Consumer Price Index (CPI). Even though the magnitude of the reaction is small, the reaction of the stock market will appear one month after the time of the announcement of the CPI.

Amihud (1996) found that unexpected inflation has a significant negative effect on stock prices in Israel, which supports the explanation of this relationship, that is based on the negative association between inflation and real activity, as well as the real cost of inflation. He also explained that a number of hypotheses suggested for the United States do not apply in Israel.

Al-Khazali (2000) found that the negative and statistically significant relationship between stock returns and inflation persists even after the effects of expected economic activity and inflation variability have been incorporated. Al-Rweidan (2005) found that there is a long-run relationship between stock prices and unanticipated inflation (not unitary relation). The contribution of this study will be in two parts. First, unlike previous studies, it applies macro model to specify the factors that the general multifactor pricing model should include. This will add evidence that the models applicable in developed countries are applicable also in emerging markets like Jordan. Second, it checked whether there are long-run and short-run relationships between unanticipated inflation and stock return.

3. METHODOLOGIES AND DATA DESCRIPTION

This study applied a version of four factor model developed by Chen, Ross and Roll (1986). Section one

described the methodology which consists of the model and hypotheses. Section two illustrates the data description and the measurement of the variables.

Methodology

Chen, Ross and Roll Model (1986)

The equation of this model:

$$R_i - R_f = \alpha_i + \lambda_{i1} F_1 + \lambda_{i2} F_2 + \lambda_{i3} F_3 + \lambda_{i4} F_4 + \varepsilon_i$$

$R_i - R_f$: The excess weighted average return of the market portfolio

F_1 is the Industrial Production

F_2 is the Expected Inflation

F_3 is the Unanticipated Inflation

F_4 is the Term Structure of Interest Rate

We conducted the Generalized Method of Moments (GMM) regression (time series Heteroskedasticity Autocorrelation (HAC)) for the macro CRR model to find if the four factors (Industrial production, unanticipated inflation, expected return and term structure) do really affect the market return (the coefficients are significantly different than zero).

Finally, we performed the Augmented Dicky-Fuller test and Phillips Perron test to determine whether or not the unanticipated inflation and stock return series are stationary. If there is a unit root, the researcher will transfer the series to the first difference. If both series are stationary we would conduct the Johansen Co-integration test to check if there is a relationship in the long run between the two series. Then, we would conduct the Grange Causality test to check if any of the variables causes the other.

Data Description

This study examined monthly data relating to common stocks listed in the industrial sector of Amman Stock Exchange from July 1997 to December 2003. The data herein is collected from several sources. Monthly market returns are taken from ASE. The treasury bills and the treasury bonds rates are taken from the Central Bank of Jordan. The industrial production and inflation are taken from Department of Statistics. The monthly data covers the period from July 1997 to December 2003; because there was no available data about government bonds before July 1997.

Over the study period (1997-2003), we collected all available stock prices relating to all companies in the industrial sector. However, the total number of companies whose stocks were handled during the study period was only eighty four. After excluding the merged companies, split stock companies and other companies whose shares were under holding case, as well as the companies stopped or started during the study period, the balance number went down to thirty two companies.

The dependent variables

R_t-R_f: The excess weighted average return of the market portfolio which represents all the companies in the sample.

The independent variables

1- Unanticipated Inflation: is an increase in the price level that comes as a surprise, at least to most individuals. For example, suppose that, based on the recent past, most people anticipate an inflation rate of three percent. If the actual inflation rate turns out to be ten percent, it will catch people off guard. When the rate of inflation is high and variable, like the rate of inflation countries, it will be virtually impossible for decision makers to anticipate future rates accurately, and long-range planning will be extremely difficult. (Gwartney, Stroup and Sobel, 2000).

2- Term Structure of Interest Rate: it describes the relationship between long-term and short-term rates. The term structure is important to corporate treasurers who must decide whether to borrow by issuing long-term or short-term debt, and to investors who must decide whether to buy long-term or short-term bonds. Thus, it is important to understand: (1) how long-term and short-term rates relate to each other and (2) what causes shift in their relative positions. (Brigham and Ehrhardt, 2002).

3- Expected Inflation: is a change in the price level that is widely expected. Decision makers are generally able to anticipate slow steady rates of inflation with a high degree of accuracy. (Gwartney, Stroup and Sobel, 2000).

4- Industrial Production: is a statistic which provides a measure of economic activity that focus on the manufacturing side of economy. It is a popular measure of the economy's output (Bodie, Kane and Marcus, 2002).

Measurement of the Variables and Forming the Portfolios

Monthly Return: The monthly return is the price of the stock in the current month minus the price of the stock in the previous month plus the dividend over the price of the stock in the previous month. This is illustrated in the following equation:

$$R_t = (P_t - P_{t-1} + D) / P_{t-1}$$

The dependent variable is the excess weighted average return of the market portfolio which represents all the companies in the sample.

Independent Variables

1- The industrial production variable is the percentage change in monthly industrial production according to the following equation:

$$\text{Industrial production (IP \%)} = [(IP_t - IP_{t-1}) / IP_{t-1}] * 100$$

2- The Unanticipated Inflation is estimated from the Consumer Price Index (CPI) using the Hodrick-Prescott Filtered, this filter decomposes the series of CPI into trend and unanticipated deviations from the trend. The unanticipated deviations are treated as the unexpected component of the series. The percentage change in this unanticipated inflation is the second variable which can be measured by the equation:

$$\begin{aligned} \text{Unanticipated inflation (UNI \%)} \\ = [(UNI_t - UNI_{t-1}) / UNI_{t-1}] * 100 \end{aligned}$$

3- The expected Inflation is the percentage monthly changes in the Consumer Price Index C.P.I. which can be measured by the equation:

$$\text{INF \%} = [(CPI_t - CPI_{t-1}) / CPI_{t-1}] * 100$$

4- Term Structure Variable: The data about the treasury bonds was available from July 1997 up to now (this was a limitation). The Central Bank of Jordan issued 2, 3, 5 years treasury bonds. We started with the interest rate of the first issue and then changed the interest rate according to each new issue. Then, we divided the interest rate each time by 12 to get the monthly rate. We started with treasury bills from July 1997. The Central Bank of Jordan issued 3, 6 and 12 months treasury bills. We started with the interest rate of the first issue then changed the interest rate according to each new issue. The interest rate of the treasury bill equals the

issue price minus the selling price, over the selling price that is for the age of the issue. To get a yearly interest rate, we multiplied the result by 365 then divided it by the age of the issue. To get a monthly interest rate, we divided the resulted yearly rate by 12. The difference between treasury bonds and treasury bills is the Term Structure.

4. EMPIRICAL RESULTS

This chapter provides the detailed results of this study. The second section of this chapter provides a brief description of the statistical techniques used. The third section provides the descriptive statistics. A detailed discussion of the regression, unit root tests, co-integration, and causality results will be outlined in the final section.

Statistical Techniques

Generalized Methods of Moments (GMM) regression is used to test the Chen, Ross and Roll model. This regression does not require information of the exact distribution of the disturbances. In fact, many common estimators in econometrics can be considered as special cases of GMM. For example, the ordinary least squares estimator can be viewed as a GMM estimator in case that each of the right-hand variables is uncorrelated with the residual. Time series (HAC) Generalized Methods of Moments estimate will be robust to heteroskedasticity and autocorrelation of unknown form.

Two widely unit root tests are used: Augmented Dickey-Fuller (ADF) test, and the Phillips-Perron (PP) test.

On the other hand, to check if there is a relationship in the long run between the variables, the Johansen's co-integration test employs two Likelihood Ratio (LR) test statistics: the maximal eigenvalue (λ -max) and trace (Tr) under the assumption that there is a linear deterministic trend in the data, no trend in VAR.

The Granger Causality test is used to check if there is a short-run relationship between the variables.

Descriptive Statistics

The mean value in Table (1) of the excess market return with dividend is -0.21 percent, for the excess market return

without dividend is 0.18 percent, for the expected inflation is 15.78 percent, for term structure is 6.92 percent and for the industrial production is 6.92 percent. As for the unanticipated inflation, it is big because the percentage change is high.

The standard deviations for excess market return with dividend, without dividend and term structure are less than 10 percent as it appears in Table (1). This means that the volatility of the returns in these portfolios is low. Industrial production and unanticipated inflation are high which means that volatility for these portfolios is very high. (Low volatility means low risk while high volatility means high risk).

Normality tests (Table 1):

- The skewness for excess market returns with and without dividend, for industrial production, and for unanticipated inflation is different than zero. While for term structure and expected inflation it is about zero which means that they have normal distribution.
- The Kurtosis for excess market return with and without dividend, for industrial production and for unanticipated inflation is different than three. For term structure and expected inflation it is about three which means that they have normal distribution.
- The Jarque-Beru values for excess market return with and without dividend, for industrial production, and for unanticipated inflation are significant to reject the null hypothesis of normal distribution. For term structure and expected inflation the Jarque-Beru values are insignificant to reject the null hypothesis of normal distribution, which means that they have normal distribution.

The Generalized Methods of Moments (GMM) regression does not require information of the exact distribution of the disturbances.

The correlation matrix in Table (2) shows the results of the correlation between the independent variables. This matrix helps to account for problems like multicollinearity among independent variables. However, the Generalized Methods of Moments regression deals with correlation of unknown form.

The Results

This study examined Chen, Ross and Roll model by the time series (HAC) Generalized Method of Moments (GMM) regression.

Table (3): R^2 -11 percent is negative which means that it's a poorly fitting model and that there is no fraction of the variance of the dependent variable explained by the independent variables, R^2 can be negative if the estimation method is two-stage least squares or GMM. The coefficients of the industrial production and term structure are insignificantly different than zero, the P values are more than 10 percent (the term structure about to be significant at 10 percent), while the percentage change in expected inflation and the percentage change in unanticipated inflation are significant at 10 percent, the coefficients are very little and have positive signs. This means that these two

variables significantly affect the excess market return.

Table (4): R^2 -11 percent is negative which means that it's a poorly fitting model and there is no fraction of the variance of the dependent variable explained by the independent variables. It can be negative if the estimation method is two-stage least squares or GMM. The coefficients of the industrial production, term structure, and expected inflation are insignificantly different than zero, the P values are more than 10 percent, while the percentage change in unanticipated inflation is significant at 10 percent. Its coefficient is very little and has a positive sign. This means that it is the only variable which significantly affects the excess market return.

Table 1: Descriptive statistics for macro dependent variables and independent variables.

	EMR	EMRD	Expected Inflation	Industrial Production	Unanticipated Inflation	Term Structure
Mean	-0.0021	0.0018	0.1578	0.0692	-33.2265	0.0692
Median	-0.0076	-0.0058	0.1949	-0.0568	-33.2985	0.0833
Maximum	0.1791	0.1791	1.8200	4.3973	3171.498	0.2233
Minimum	-0.1167	-0.1167	-2.0561	-3.3558	-2609.363	-0.1192
Std. Dev.	0.0468	0.0461	0.7481	0.9645	670.7990	0.0915
Skewness	1.1465	1.1019	-0.3634	0.5060	0.1569	-0.4232
Kurtosis	5.9160	5.8674	3.0145	9.3818	13.0613	2.5488
Jarque-Bera	44.7239	42.5039	1.71761	135.6946	329.3201	2.9897
Probability	0.0000	0.0000	0.4237	0.0000	0.0000	0.2243
Observations	78	78	78	78	78	78

EMR: the Excess Market Return.

EMRD: the Excess Market Return with Dividend.

Table 2: The correlation matrix among the macro variables.

	Expected Inflation	Industrial Production	Unanticipated Inflation	Term Structure
Expected Inflation	1			
Industrial Production	0.025	1		
Unanticipated Inflation	-0.221	-0.045	1	
Term Structure	0.188	0.059	-0.035	1

Unit Root Results

The prerequisite in applying the co-integration procedure is to make the unit root properties for the series. So, this study used the Phillips Perron (PP) statistics and the Augmented Dickey-Fuller (ADF) statistics. The null hypothesis is: there is a unit root in the unanticipated inflation, and there is a unit root in the excess market return with dividend and without dividend. If the null hypothesis is rejected, it means that the time series is stationary.

The results in Table (5) show that the null hypothesis of the unit root had been rejected under the Phillips Perron test at 1 percent, 5 percent and 10 percent significance level in the three cases: with intercept, with intercept and trend, and without intercept or trend for unanticipated inflation and for the excess market return with and without dividend. This indicates that the three series are stationary I(0) at 1% significance level.

The results in Table (6) show that the null hypothesis of the unit root had been rejected under the Augmented Dickey-Fuller test at 1 percent, 5 percent and 10 percent significance level in three cases: with intercept, with intercept and trend, and without intercept or trend; for unanticipated inflation and for the excess market return with and without dividend. This indicates that the three series are stationary I(0) at 1% significance level.

Co-integration Results

The Johansen procedure employs two Likelihood Ratios (LR) test statistics: the maximal eigenvalue (λ -max) and trace (Tr) to test the presence or absence of long-run relationship between the variables. The null hypothesis under maximal eigenvalue (λ -max) is that the number of co-integration is r against the alternative of r +1. The null hypothesis under the (λ -trace) is that the number of co-integration is less than or equal to r against the alternative that "there are more than r".

The result in Table (7) are as follows: panel A indicates the presence of two co-integrations between the excess market return and unanticipated inflation under the assumption that there is a linear deterministic trend in the data, no trend in VAR, which means that it is possible to forecast using the historical prices of the other series in the long run.

The result in Table (7) also show that panel B indicates the presence of two co-integrations between the excess market return with dividend and the unanticipated inflation, under the assumption that there is a linear deterministic trend in the data, no trend in VAR, which means that it is possible to forecast using the historical prices of the other series in the long run.

Table 3: Regressions of excess stock market return on the industrial production, expected inflation, unanticipated inflation and term structure

$$EMR=C(1)+C(2)*Industrial\ Production +C(3)*Expected\ Inflation +C(4)*Unanticipated\ Inflation +C(5)*Term\ Structure$$

Without dividend

	Coefficient	t-Statistic	Prob.
C(1)	-0.021972	-3.351802	0.0013
C(2)	-0.004849	-0.844816	0.4010
C(3)	0.010728	1.735603	0.0869
C(4)	1.40E-05	2.133534	0.0362
C(5)	0.103473	1.641158	0.1051
R-squared		-0.112973	
Adjusted R-squared		-0.173958	
S.E. of regression		0.050714	

EMR: the Excess Market Return.

C(2): the coefficient of industrial production.

C(3): the coefficient of the expected inflation.

C(4): the coefficient of unanticipated inflation.

C(5): the coefficient of the term structure.

Table 4: Regressions of excess stock market return on the industrial production, expected inflation, unanticipated inflation and term structure.

$$\text{EMRD} = C(1) + C(2) * \text{Industrial Production} + C(3) * \text{Expected Inflation} + C(4) * \text{Unanticipated Inflation} + C(5) * \text{Term Structure}$$

With dividend

	Coefficient	t-Statistic	Prob.
C(1)	-0.017981	-2.960327	0.0041
C(2)	-0.004931	-0.881846	0.3808
C(3)	0.008937	1.390778	0.1685
C(4)	1.19E-05	1.887004	0.0631
C(5)	0.091259	1.412365	0.1621
R-squared	-0.112213		
Adjusted R-squared	-0.173156		
S.E. of regression	0.049954		

EMRD: the Excess Market Return with Dividend.

C(2): the coefficient of industrial production.

C(4): the coefficient of unanticipated inflation.

C(3): the coefficient of the expected inflation.

C(5): the coefficient of the term structure.

Table 5: Unit root tests for the original series (PP).

Phillips-Peron	Intercept	Intercept and Trend	No Intercept nor Trend
Unanticipated Inflation	-4.68*	-4.66*	-4.7*
Excess Market Return	-9.9*	-11.06*	-9.72*
Excess Market Return with Dividend	-9.9*	-10.99*	-9.85*
Critical Value at 1%	-3.49	-4.05	-2.58

*Significance at 1%, 5% and 10%.

Table 6: Unit root tests for the original series.

Augmented Dickey-Fuller	Intercept	Intercept and Trend	No Intercept nor Trend
Unanticipated Inflation	-5.43*	-5.41*	-5.46*
Excess Market Return	-6.46*	-7.68*	-6.31*
Excess Market Return with Dividend	-6.93*	-8.27*	-6.92*
Critical Value at 1%	-3.49	-4.05	-2.58

*Significance at 1%, 5% and 10%.

Table 7: Johansen co-integration test.

Panel A: Without Dividend

	Likelihood	5 Percent	1 Percent	Hypothesized
Eigenvalue	Ratio	Critical Value	Critical Value	No. of CE(s)
0.217115	40.38901	25.32	30.45	None **
0.137014	15.17779	12.25	16.26	At most 1 *
(**) denotes rejection of the hypothesis at 5%(1%) significance level				
L.R. test indicates 2 co-integrating equation(s) at 5% significance level				

Panel B: With Dividend

	Likelihood	5 Percent	1 Percent	Hypothesized
Eigenvalue	Ratio	Critical Value	Critical Value	No. of CE(s)
0.218516	40.16525	25.32	30.45	None **
0.133587	14.76951	12.25	16.26	At most 1 *
*(**) denotes rejection of the hypothesis at 5%(1%) significance level				
L.R. test indicates 2 co-integrating equation(s) at 5% significance level				

Granger Causality Results

The result in Table (8) shows that panel A indicates that neither the excess market return causes the unanticipated inflation nor the unanticipated inflation causes the excess market return.

Also, Table (8) shows that panel B indicates that neither the excess market return with dividend causes the unanticipated inflation nor the unanticipated inflation causes the excess market return with dividend.

Inflation Regression

The result in Table (9) indicates that the coefficient between the independent variable, unanticipated inflation, and excess market return dependent variable is positive, but it is insignificantly different than zero. So, the result indicates that the unanticipated inflation does not affect the excess market return. R^2 is very little which means that the variation in the unanticipated inflation cannot explain the variation in the excess market return.

The result in Table (10) indicates that the coefficient between the independent variable, expected inflation, and excess market return dependent variable is positive, but insignificantly different than zero. So, the result indicates that the anticipated inflation does not affect the excess market return. R^2 is 0.5 percent which means that the variation in the anticipated inflation can explain only 0.5 percent from the variation in the excess market return.

5- SUMMARIES AND CONCLUSION

The purpose of this study is to examine the macro level

model; the one that was developed by Chen, Ross and Roll in the industrial sector in Amman Stock Exchange. Johansen and Granger procedures are utilized to test the presence or absence of long-run and short-run relationships between the variables.

We studied the relationship between economic variables and stock market returns to identify the macroeconomic risk factor. Several conclusions have emerged from this investigation.

First: The Chen, Ross and Roll model has a negative explanatory power, which means that this is a poorly fitting model, and it cannot explain the variations in average stock return.

Second: Two factors (the industrial production and term structure) have insignificant slopes which contradicts Chen, Ross and Roll (1986), Ericsson and Karlsson (2004), Roa and Radjeswari (2000), while they are consistent with Rapach, Wohar and Rangvid (2003) whose studies show limited industrial production in most countries. In particular, the industrial production affects profit which will influence the return, but it seems that the industrial production has no effect in this study.

Third: The expected inflation has a significant positive slope when the dependent variable excess market return without dividend is applied, while insignificant slope when the dependent variable excess market return with dividend is used. The result is consistent with Roa and Radjeswari (2000), with Rapach, Wohar and Rangvid (2003) and with Flannery and Protopapadakis (2001).

Fourth: The unanticipated inflation has significant positive slope. This is the only variable consistent with the

Chen, Ross and Roll model. The positive sign of the unanticipated inflation coefficient means that we can consider stocks as an inflation hedge and it is consistent with the Fisher effect, while it is contradicted with the proxy effect hypothesis.

Summary: This study shows that the Chen, Ross and Roll model cannot explain the variation in stock return. The only factor that affects the excess market return is the unanticipated inflation.

The results also show that there is a long-run relationship between the unanticipated inflation and excess market return, which means that it is possible to forecast using the historical prices of the other series in the long run. However,

there is no relationship between them in the short run, which means neither the unanticipated inflation causes excess market return nor the excess market return causes unanticipated inflation. The stock market reacts to the announcement of unanticipated inflation in the Consumer Price Index after the period of the announcement. The regression results showed that neither the unanticipated inflation affects the excess market return nor the expected inflation affects the excess market return when taking a long period of time for regression, which means that the characteristics of the companies are the factors which affect the return.

Table 8: Granger causality test.

Panel A: Without Dividend

Null Hypothesis:	Obs	F-Statistic	Probability
UNANTICIPATED does not Granger Cause EMR	106	0.46367	0.63030
EMR does not Granger Cause UNANTICIPATED		0.13789	0.87136

Panel B: With Dividend

Null Hypothesis:	Obs	F-Statistic	Probability
UNANTICIPATED does not Granger Cause EMRD	106	0.75236	0.47387
EMRD does not Granger Cause UNANTICIPATED		0.75712	0.47166

Table 9: Regressions of excess stock market return on the unanticipated inflation.

$$EMR=C(1)+C(2)*Unanticipated\ Inflation$$

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.008249	0.004498	-1.833886	0.0695
C(2)	0.001862	0.003950	0.471468	0.6383
R-squared	0.002093	Mean dependent var		-0.008249

EMR: the Excess Market Return.

C(2): the coefficient of unanticipated inflation.

Table 10: Regressions of excess stock market return on the expected inflation

$$EMR=C(1)+C(2)*expected\ Inflation$$

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.008986	0.004593	-1.956419	0.0530
C(2)	0.003780	0.004950	0.763663	0.4468
R-squared	0.005472	Mean dependent var		-0.008249

EMR: the Excess Market Return.

C(2): the coefficient of the expected inflation.

REFERENCES

- Amihud, Y. 1996. Unexpected Inflation and Stock Returns Revisited-Evidence from Israel. *Journal of Money*, 28: 22-33.
- Banz, R. 1981. The Relationship between Return and Market Value of Common Stocks, *Journal of Finance Economics*, 9: 13-18.
- Bodie, Z., Kane, A. and Marcus, A. 2002. *Investments*, The McGraw-Hill.
- Brigham, E. and Ehrhardt, M. 2002. *Financial Management*, Thomson Learning.
- Burmeister, E., Roll, R. and Ross S. 2003. *Using Macro Factors to Control Portfolio Risk*.
- Elton, E. and Gruber, M. 1995. *Modern Portfolio Theory and Investment Analysis*, John Wiley and Sons.
- Fama, E. and French K. 1992. The Cross-Section of Expected Stock Return. *Journal of Finance*, 47: 427-465.
- Fama, E. and French K. 1993. Common Risk Factors in the Return on Stocks and Bonds. *Journal of Financial Economics*, 33: 3-56
- Flannery, M. and Protopapadakis, A. 2001. Macroeconomic Factors Do Influence Stock Return. *Review of Financial Studies*.
- Gwartney, J., Stroup, R. and Sobel, R. 2000. *Economics Private and Public Choice*. The Dryden Press.
- Haugen, R. 1997. *Modern Investment Theory*, Prentice-Hall, London.
- Khazali, O. 2000. *Empirical Tests of the Proxy Hypothesis: Evidence From Jordan*. Working Paper, American University of Sharjah.
- Lambrick, S. 2005. *Economic Variables And The Stock Market*. Working Paper.
- Mei, J. 1993. Explaining the cross-Section of Returns via a Multi-Factor APT Model. *Journal of Finance*, 28: 331-345.
- Rapach, D., Wohar, M. and Rangvid, J. 2003. *Macro Variables and International Stock Market Return Predictability*.
- Roa, C. and Radjeswari, A. 2000. *Macro-economic Factors and Stock Prices in India: A Study*. Capital Market Conference Organized by UTI institute.
- Roll, R. and Ross, S. *The Arbitrage Pricing Theory Approach to Strategic Portfolio Planning*.
- Rweidan, K. 2005. Inflation and Excess Stock Returns: Evidence from Jordanian Industrial Companies. Master Thesis, Hashemite University.
- Schall, L. 1984. Taxes, Inflation and Corporate Financial Policy. *The Journal of Finance*, 39: 105-126.
- Schwert, W. 1981. The Adjustment of Stock Prices to Information about Inflation. *The Journal of Finance*, 36: 15-29.
- Seitz, N. and Ellison, M. 1999. *Capital Budgeting and Long-Term Financing Decisions*, The Dryden Press.

تفسير عوائد الأسهم من خلال نموذج متعدد العوامل الاقتصادية على المستوى الشامل

خالد عبد العال الزعبي وحسين سلامة*

ملخص

بحثت هذه الدراسة العلاقة بين العوامل الاقتصادية وعوائد الاسهم في قطاع الصناعة في سوق عمان المالي، حيث اعتمدت قراءات شهرية لمدة ست سنوات ونصف للفترة من تموز 1997 ولغاية كانون الاول 2003 باستخدام قيم العوائد المرجحة بالحجم. تم فحص أربعة عوامل (الانتاج الصناعي، التضخم المتوقع، التضخم غير المتوقع، واخيرا الفرق في سعر الفائدة بين سندات الخزينة واذونات الخزينة). وبينت النتائج ان هنالك عاملين فقط يؤثران في عوائد الاسهم عند اخذ العوائد دون التوزيعات، وهما التضخم المتوقع والتضخم غير المتوقع، وان هناك عاملاً واحداً يؤثر في عوائد الاسهم عند اخذ العوائد مع التوزيعات هو التضخم غير المتوقع. وبينت الدراسة ايضا ما اذا كانت هناك علاقة على المدى الطويل والمدى القصير بين التضخم غير المتوقع وعوائد الاسهم. وبينت النتائج ان هناك علاقة على المدى الطويل بين العاملين، لكن لا توجد علاقة على المدى القصير بين العاملين.

Khaled A.Al-Zubi and Hussain Salameh

Department of Finance and Banking Sciences, Faculty of Economics and Business Administration, The Hashemite University, Zarqa, Jordan.

تاريخ استلام البحث 2006/3/22، وتاريخ قبوله 2007/1/14.