Penn Institute For Economic Research

Penn Institute for Economic Research
Department of Economics
University of Pennsylvania
3718 Locust Walk
Philadelphia, PA 19103-6297

pier@ssc.upenn.edu
http://www.econ.upenn.edu/pier

PIER Working Paper 97-036

"Stock Market Returns and Economics Fundamentals in an Emerging Market: The case of Korea"

by

Fangxiong Gong and Robert S. Mariano

Stock Market Returns and Economic Fundamentals in an Emerging Market: The Case of Korea

Fangxiong Gong[1]

Capital Markets Function
Federal Reserve Bank of New York,
New York, NY 10045-0001

Roberto S. Mariano

Department of Economics,
University of Pennsylvania,
Philadelphia, PA 19104

Preliminary Manuscript: August, 1994

This Version: May, 1996

Abstract

This paper investigates the feedback relationship between stock market returns and economic fundamentals in an emerging market. Starting from an intertemporal consumption-based CAPM (CCAPM), we obtain a restricted VAR model for stock returns and macroeconomic variables. We then apply this model to Korea and find statistically significant departures from the restrictions implied by CCAPM. Consequently, an unrestricted VAR model is used to analyze the variations of expected and unexpected returns in the Korean stock market. It is shown that the expected market returns vary with a set of macroeconomic variables, and that the predictable component is substantial. Reflecting richer dynamics in the data, relative to the usual single equation modeling in the literature, the estimated VAR model shows considerable predictive ability for both real economic activity and real returns. Using the model for a variance decomposition of unexpected returns, we find that, although we cannot directly observe the market's revision of expected future dividend growth, we can estimate a large part of the revision with the news in the expected industry output growth from our VAR model. Finally, we also find that economic fundamentals can explain only a small portion of the variation in unexpected returns in the Korean stock market.

Key Words: Asset Pricing, Consumption Based CAPM, Emerging Markets, Expected Returns, Unexpected Returns, Vector Autoregressive Processes, Variance Decomposition

[1]We acknowledge useful suggestions and comments from Joseph Gyourko, two anonymous referees, and seminar participants at the Federal Reserve Bank of New York, participants of conferences of the Asian Securities Industry Institute (ASII) and the Seventh Annual Conference of PACAP in Manila, Philippines where an earlier version of this paper was presented. The views expressed in the paper are those of the authors and are not necessarily reflective of views at the Federal Reserve Bank of New York or the Federal Reserve System.

1 Introduction

This paper investigates the feedback relationship between stock market returns and economic fundamentals in an emerging market. Many Asian countries have enjoyed rapid economic growth. From 1983-1994, the annual average growth rate of real GDP was 9.8% for China, 9.4% for Korea, 8.3% for Taiwan, and 8.1% for Thailand. Long-term stock market returns there have also outperformed other markets around the world. However, emerging markets also fluctuate wildly. In 1993, the stock market index returns in Hong Kong, Malaysia, and Philippines were all above 100%. In 1994, these markets suffered considerable losses: the Hong Kong Hang Seng index fell 32%, Malaysia's Kuala Lumpur stock exchange index slid 25%, and the Manila stock exchange index dropped 15%. How efficient are the financial markets in Asia? Are the market returns predictable from economic fundamentals? To what extent does the variation of returns and expected returns reflect changing economic fundamentals?

Modeling the interaction between financial markets and the macroeconomy has been an important issue in both theoretical and empirical capital asset pricing models (CAPM). The intertemporal asset pricing literature (Lucas (1978) and Abel (1988) are two examples) links the time-varying expected returns with changing economic fundamentals. Stock returns are functions of economic state variables that summarize the time-varying consumption and investment opportunities. Thus, predictability of stock returns need not mean that the market is inefficient, as long as the predicted movement in stock returns is consistent with the predicted future economic conditions. This kind of predictable component in returns cannot be arbitraged away since it is a result of people's intertemporal maximization decisions.

To empirically investigate the behavior of expected and unexpected returns, simple regression methods, as in Fama(1990a) and Chen(1991), have been applied to the U.S. market to study the relationship between market returns and economic fundamentals. In this paper, like Campbell and Ammer (1993)'s analysis to the U.S. market, we utilize a vector-autoregression (VAR) model to better capture the rich dynamics in the data and the feedback relationship. We show that a consumption-based CAPM (CCAPM) reduces to a restricted VAR model which includes both asset return and consumption/output variables. The restrictions follow from consistency requirements by the theory on the relationship between the predictability of market returns and that of the fundamentals.

While many studies exist based on the U.S. financial market, very little is known about the interaction between financial markets and real economic activities in emerging market economies. In this paper, we analyze empirical evidence based on the Korean economy and its stock market to address this issue. Korea is one of the most important emerging markets in Asia. Since the mid-1960s, Korea has experienced tremendous economic success. In only a single generation, Korea has leaped from being one of the world's poorest countries to the edge of full industrialization. This rapid economic growth with continuously changing economic fundamentals provides an ideal environment for our analysis. Korea also has an active and growing stock market, and it has shown rapid gains–growing by more than ten times in terms of market value between 1980 and 1994.

Empirical evidence from the Korean economy rejects the restrictions imposed on the VAR model by the CCAPM. But this result alone does not necessarily mean that the Korean market is inefficient. It could simply indicate that the single factor CCAPM is not adequate to describe the expected return variations in the Korean market. Consequently we estimate an unrestricted VAR model for Korea and use it to decompose the variation of unexpected stock returns into changes in expectations of future cash flows as captured by economic fundamentals, changes in expected returns, and a noise term.

The unrestricted VAR shows that expected returns in the Korean stock market vary with a set of macroeconomic variables, and the predictable component is substantial. We also find that current returns are correlated with lagged returns even when conditioned on the presence of other economic state variables. On the issue of market efficiency, it is shown that the same set of economic state variables as proxied by the lagged variables in the VAR system can both predict economic activity and market returns, and current market returns correlate positively with future economic growth. The positive correlation that we have established empirically, should be interpreted simply as a result of the forecasting behavior of the market. There is no evidence for structural causality from current stock returns to future industry growth.

Our analysis of unexpected stock returns suggests that economic fundamentals can explain only a small portion of the variation in unexpected stock returns in Korea. Correlation analysis of the components of unexpected stock returns indicates that, although we cannot directly observe the market's revision of expectations of future dividend growth, we can estimate a large part of the revision by the news in the expected industry output growth from our VAR model. We also find that the unconditional correlation between unexpected stock returns and the news about expected returns is negative.[2] It is also shown that there is a high correlation between expected return news and dividend-related industry growth news. Unexpected returns seem to be less correlated with the growth-related dividend news, but are highly correlated with the dividend news unrelated to industry growth.

In the following sections, we first briefly review the existing theoretical literature and empirical evidence from the U.S. economy on the relationship between asset returns and economic conditions. This is followed by a description of the data used in our analysis. For a direct comparison with the empirical findings on the U.S. we apply simple regressions in section 4, as in Fama (1990a) and Schwert (1990), to examine the information in stock market returns and the relationship between returns and economic activity in Korea. In section 5 we first show that the CCAPM reduces to a VAR model that includes stock returns and other economic variables and that there are parameter restrictions on this VAR model. These restrictions are then tested and rejected by the Korean data. We then proceed to analyze expected returns and

[2] According to Campbell and Shiller (1988), conditioned on dividend news, the correlation is negative; but the unconditional correlation can go either way.

decompose the variance of unexpected returns using an unrestricted VAR model to see how the variations in real economic activity affect the variations of expected and unexpected stock returns.

2 Financial Market Returns and the Macroeconomy in Asset Pricing

2.1 Theory

Intertemporal asset pricing models, such as Lucas (1978) and Abel (1988), provide direct linkage between financial markets and macroeconomic conditions. In these models, equilibrium stock prices (and returns) are functions of economic state variables that are correlated with changes in consumption and investment opportunities. Stocks are claims against future output, and investors are forward looking and want to hedge against future uncertainty in consumption and investment. Changes and expected changes in the aggregate economy will therefore affect investors' saving and investment behavior, and in turn affect equilibrium asset returns and expected returns.

A factor that links the macroeconomy and the stock market is investors' risk aversion. An example in Chen (1991) shows that if the consumption level is lower, agents will be more risk averse. Hence, the market needs a higher expected premium to attract investors, and this would bring down the current stock price.

Consumption smoothing also provides a linkage between equilibrium market returns and macroeconomic conditions. If output is expected to grow, on one hand the expected dividend increases thus raises expected stock returns. On the other hand agents will try to smooth out consumption when they expect their life-time wealth to increase. They will borrow against their future wealth and thus the interest rates will also increase. Excess returns could go either way, depending on other parameters of the economy.

If there is a negative shock to current income, people would save less, and invest less, or even sell some stock holdings to smooth out the effect on current consumption. This will also bring down stock prices and raise expected returns.

Abel (1988), in a Lucas (1978)-type economy, explicitly derives the relationship between expected market return, market premium, current and expected output, and uncertainty about future output. He shows that both the expected return and the excess return vary inversely with current output, which is consistent with the consumption smoothing and risk aversion story. The expected return and premium are positively correlated with expected future output. The excess return is positively related to a measure of the conditional uncertainty of production.

2.2 Evidence in the U.S.

There has been substantial empirical work based on U.S. data. Fama (1990a) finds a positive correlation between stock returns and future industry output growth. Chen (1991) finds empirical evidence that the current health of the US economy, as measured by current and recent growth rate of output, is negatively correlated with expected returns in the stock market. He also finds that there is a positive correlation between expected growth rate of GNP and the expected stock market return. Fama and French (1988,1989), Chen (1991) provide empirical evidence that a set of financial state variables, such as term premium, risk premium as measured by the yield on low-grade bonds and high-grade bonds, short-term interest rates, and the dividend-price ratio, can predict both stock returns and the growth rate of GNP, and the prediction is consistent with the implications of asset pricing theorems. Estrella and Hardouvelis (1991) also find that the term structure can predict a variety of real economic activities.

Fama (1990b) finds that the term structure of interest rate can forecast changes of the inflation rate in a variety of horizons for the U.S. economy, and that the term spread and inflation rate are positively correlated. Also, the term premium can predict real bond returns in a relatively shorter horizon, and the correlation between the term spread and expected real return is negative. Overall, there is a positive correlation between the term spread and future spot rates, but it is less significant due to the opposite sign of the spread in forecasting inflation and real returns. It is interesting to note that patterns of the cyclical variation of term spread of interest rate and their predictions of real return, inflation and spot rate are consistent with the consumption smoothing hypothesis and the permanent income hypothesis.

One of the stylized facts about the term structure is that interest rates are procyclical (Fama, 1986). That is, the one-year spot rate is lower at the business trough than at the preceding or the following peak, as shown in Fama (1990b). Another observation is that the term spread or the slope of the yield curve is countercyclical: short rates rise much more than long rates during business expansions. Thus, near cycle peaks, the slope of the yield curve is flat. In contractions, however, short rates fall much more than long rates; thus, near troughs, the slope is steep. The positive correlations of the term spread with expected inflation and the spot rate show that we would predict declines in the latter two variables in contractions, and increases in expansions. The negative correlation between the term spread and changes in real return would lead us to expect the real return to increase in contractions and decrease in expansions.

3 Data Description

From the previous section, we see that in the U.S. there is considerable empirical evidence for the linkage between the financial markets and the macroeconomy. However, there have been no such comparable studies for emerging markets. Part of the reason is that, for emerging market economies, yields and yield spreads data are not available because there are no comparable bond markets. The usefulness of the information in interest rates is also limited because the money markets and short-term T-bill markets are usually regulated and there is no open-bidding process.

Data availability puts limitation on the study of emerging market economies in Asia. The International Monetary Fund(IMF) has a data base going back to the early 1970s, which contains most of the macroeconomic variables for each of the Asian countries. The International Finance Corporation's (IFC) Emerging Market Indices have time series of monthly stock market total return index (including dividend reinvestment), and 12-month rolling dividend yield. The Korean series start from January 1976.

The IMF and IFC data base can be accessed from Datastream (DS). From the IMF data set we collected monthly time series for industrial production index Y_t (DS code KOI66..CE), consumer prices index CPI_t (DS code KOI64...F, only this seasonally unadjusted index is available), domestic credit $Dcrd_t$ (DS code KOI32...A, this series is in current prices, not seasonally adjusted), and money supply M_t (DS code KOI34...A, current prices, not seasonally adjusted). The monthly market total return index RI_t (DS code IFCKORL(RI), in local currency) and 12 month rolling dividend yield dy_t (DS code IFCKORL(DY), in local currency) series are from the IFC data base. For some reason, the domestic credit series stopped after December 1990, but we have data for all the other series from 1976:1 to 1994:12. In the VAR model which contains the domestic credit variable, the sample period is from 1976:1 to 1990:12.

There are no term structure data on Korea. Cheung, He, and Ng (1994) find that the U.S. term spread has predictive power for Pacific-basin stock markets. Hence, we collected yields on 30-year U.S. government bond and 3-month T-bill data from CITIBASE, to see if the U.S. term structure has predictive power for the Korean market. Existing literature has already shown that the U.S. term structure is a powerful predictive variable for the U.S. real economic activity. Korea has an export-oriented economy and the U.S. business cycle could affect the Korean economy. Thus, we expect the U.S. term structure to have some predictive power for the stock market and real economic activity in Korea.

The following lists the definitions of the variables used in our empirical analysis. Through out the paper, Δ represents the first difference operator.

π_t: Monthly inflation rate at t, $\pi_t = \log CPI_t - \log CPI_{t-1}$.

r_t: Real monthly return on the Korean stock market index at time t. $r_t = (\log RI_t - \log RI_{t-1}) - \pi_t$, where RI_t is the monthly total return index.

$r(t_1, t_2)$: Real return on the Korean market index from t_1 to t_2; $= \log RI_{t_2} - \log RI_{t_1} - \pi_{t_2}$.

g_t: Monthly industry output growth rate at t; $= \log(Y_t) - \log(Y_{t-1})$, where Y_t denotes the industry output index at time t.

$g(t_1, t_2)$: Industry growth rate from month t_1 to t_2; $= \log Y_{t_2} - \log Y_{t_1}$.

dy_t: Dividend yield for the Korean market at time t.

yds_t: The yield spread as measured by the difference between the yield on 30-year U.S. government bond and 3-month U.S. T-bill.

ΔInf_t: Changes in monthly inflation rate at time t; $= \log(\pi_t) - log(\pi_{t-1})$.

ΔM_t: Monthly growth rate in total money supply at time t; $= \log(M_t) - log(M_{t-1})$, where M_t denotes total money supply at time t.

$\Delta Dcrd_t$: Changes in monthly domestic credit; $= \log(Dcrd_t) - log(Dcrd_{t-1})$, where $Dcrd_t$ denotes domestic credit at time t.

4 Returns, Expected Returns, and Real Activity: Simple Regression Evidence

Before going to the VAR modeling, we present some of the empirical evidence from simple regression analysis so that we can compare the results for Korea with the results for the U.S. reported by Fama (1990a).

4.1 Real Returns and Industry Growth

Cheung, He, and Ng (1994) studied the relationship between the Pacific-Basin stock returns and real economic activity. But they investigated only the global economic effects as captured by the U.S. and Japanese industry growth rates. Although many Asian countries have export-oriented economies so that global economic conditions are factors in stock market returns, we believe local factors would be more important given that many of those markets are restricted and not well integrated in the global financial market. To understand the interaction between financial markets and real economic activity, we have to see how the returns reflect the local factors.

As in Fama (1990a) and Schwert (1990), we regress monthly, quarterly, and annual returns on current and future industry production growth rates, as follows:

$$r(t, t+T) = a_T + \sum_{k=0}^{N} b_{Tk} g(t+3k, t+3k+3) + \epsilon_{t,t+T}, \tag{1}$$

where a is a constant and $T = 1$ for monthly, $T = 3$ for quarterly, and $T = 12$ for annual return regressions. We choose the lead N the same way as Fama (1990a) so that one could compare our results with Table III of Fama (1990a) directly–that is, $N = 3$ for monthly, $N = 4$ for quarterly, and $N = 7$ for annual.

The regression results and the T-statistics, adjusted for heteroskedasticity and serial correlation, are shown in Table 1.

	Monthly $r(t,t+1)$		Quarterly $r(t,t+3)$		Annual $r(t,t+12)$	
	b	t(b)	b	t(b)	b	t(b)
constant	-0.00	-0.09	-0.01	0.22	-0.29	-3.14
$g(t,t+3)$	0.12	0.58	0.44	1.12	2.47	2.78
$g(t+3,t+6)$	0.29	1.60	1.04	2.44	3.60	5.14
$g(t+6,t+9)$	0.06	0.35	0.58	1.36	3.49	5.05
$g(t+9,t+12)$	0.19	1.03	0.26	0.80	1.40	1.45
$g(t+12,t+15)$			-0.31	-0.78	0.61	0.73
$g(t+15,t+18)$					1.46	2.22
$g(t+18,t+21)$					2.04	2.38
$g(t+21,t+24)$					1.24	1.29
R^2	0.03		0.10		0.50	
Adjusted R^2	0.00		0.07		0.47	

Table 1: Regressions of Monthly, Quarterly, and Annual Korean Market Real Returns on Contemporaneous and Future Production Growth: 1976-1989

We see that, in Korea, market returns contain information about future industry production. And, as found by Fama (1990a) for the U.S. market, the longer the horizon, the higher the R^2, suggesting that real economic activity accounts more for long-term stock market returns than for short-term returns. As shown in Table 1, current and future industry growth can account for 50% of the annual stock return variations in Korea, higher than what Fama found for the U.S.: 43% for annual value weighted NYSE real returns. But the short-horizon returns seem to be more noisy in Korea. Current and future industry growth can only explain 3% to 10% of monthly and quarterly stock returns, compared with 6% to 20% for the NYSE real returns as reported by Fama (1990a).

Fama (1981), Geske and Roll (1983), and Kaul (1987) attribute the connection between real stock returns and industry output growth rate to the forecasting behavior of the stock market. Stock prices are the expected discount value of future cash flows/dividends, and industry growth can act as a proxy for shocks to future cash flows. In fact, in a Lucas (1978)-type economy, log returns can be expressed as

$$\begin{aligned} r_{t+1} &= c + log(D_{t+1}/D_t) \\ &= c + log(Y_{t+1}/Y_t), \end{aligned}$$

where the dividend $D_t = constant * Y_t$, Y_t is output, and c is a constant. Thus, real returns from time t to $t+1$ are connected directly to industry growth rate from time t to $t+1$.

The above regressions suggest that the Korean stock market can effectively price future real economic activities into its long-horizon returns. Since future industry growth can be predicted by other known economic variables, this suggests that stock returns could also be predicted by these economic variables.

4.2 Returns and Expected Returns

Here we consider additional factors in the expected returns in equation (1):

$$r(t; t+T) = \alpha_T + \gamma_T X(t) + \sum_{k=0}^{N} b_{Tk} g(t+3k, t+3k+3) + \epsilon_{t,t+T}, \tag{2}$$

where $X(t)$ is a set of variables known at time t.

More specifically, we investigate the predictability of Korean market returns with the dividend yield dy_t, current strength of the economy as measured by $g(t-12, t)$, and the yield spread yds_t.

The regression result for expected returns is shown in Table 2.

We see that, contrary to the evidence in the U.S., where dividend yield and the current health of the economy can predict stock returns, these two variables have

	Monthly $r(t,t+1)$		Quarterly $r(t,t+3)$		Annual $r(t,t+12)$	
	γ	$t(\gamma)$	γ	$t(\gamma)$	γ	$t(\gamma)$
constant	0.01	0.37	0.01	0.29	-0.00	-0.02
dy_t	-0.00	-0.45	-0.01	-0.43	0.01	0.18
$g(t-12,t)$	0.13	1.58	0.30	1.17	-0.10	-0.13
yds_t	0.26	0.46	0.01	0.56	0.11	2.61
R^2	0.02		0.04		0.25	
Adjusted R^2	0.00		0.02		0.23	

Table 2: Regressions of Monthly, Quarterly, and Annual Korean Market Real Returns on Predictive Variables, 1976-1989

no predictive power for monthly, quarterly and annual returns in Korea. While the U.S. yield spread cannot predict monthly and quarterly returns, it can predict annual stock returns in Korea. The adjusted R^2 for annual returns is 23%, suggesting that almost one-quarter of the annual variation of stock returns in Korea can be accounted for by the regression.

As found by Estrella and Hardouvelis (1991), the U.S. term structure has a clear business cycle pattern. The yield curve is steep around business cycle troughs, predicting higher economic growth ahead; it is flat around business cycle peaks, predicting lower growth ahead. Since the U.S. economy is the dominating force in the global setting and Korea has an export-oriented economy, which is subject to global economic swings, it is not surprising that the U.S. yield spread can predict Korea stock returns.

But if the U.S. yield spread only reflects information about future economic growth, its predictive power would disappear if we include future growth rate in the regressions. The results of the regression, based on equation (2), are shown in

	Monthly $r(t,t+1)$		Quarterly $r(t,t+3)$		Annual $r(t,t+12)$	
	b	t(b)	b	t(b)	b	t(b)
constant	0.00	0.04	-0.02	-0.21	-0.56	-2.09
dy_t	-0.01	-0.84	-0.02	-0.44	0.09	0.72
$g(t-12,t)$	0.15	1.64	0.33	1.03	0.59	1.14
yds_t	-0.01	-0.94	-0.01	-0.63	0.04	1.49
$g(t,t+3)$	0.11	0.45	0.39	0.92	2.66	2.57
$g(t+3,t+6)$	0.29	1.56	0.97	2.11	3.22	4.08
$g(t+6,t+9)$	0.13	0.74	0.63	0.46	3.16	5.15
$g(t+9,t+12)$	0.33	1.64	0.49	1.37	1.28	1.34
$g(t+12,t+15)$			-0.09	-0.17	0.92	1.22
$g(t+15,t+18)$					1.71	2.90
$g(t+18,t+21)$					2.03	2.48
$g(t+21,t+24)$					1.33	1.65
R^2	0.05		0.12		0.55	
Adjusted R^2	0.00		0.07		0.51	

Table 3: Regressions of Monthly, Quarterly, and Annual Korean Market Real Returns on Predictive Variables, Contemporaneous and Future Production Growth: 1976-1989

Table 3.

As expected, in the annual return regression, the U.S. yield spread is no longer significant. We can conclude that most of the information captured in the yield spread is not orthogonal to that in the industry growth variables. Comparing Tables 1 and 3, we also see that adjusted R^2 for the annual regression increases from 47% to 51%, although the expected return variables are not individually significant in the regressions. That is, half of the variation in annual Korean market returns can be explained by the variation in expected returns and variation in future cash-flow growth.

5 VAR Analysis: Implications From Intertemporal Asset-Pricing Theory

5.1 Motivation for VAR Analysis

Simple regressions as in Fama (1990a), and Chen (1991) can reveal the correlation between stock returns and contemporaneous and future economic growth. However, as argued by Campbell and Ammer (1993), the methodology tells us nothing about the dynamics between stock market returns and macroeconomic activity. For example, it could be that both stock market returns and current and future economic growth are responding to a change in monetary policy, a shock in domestic credit, or a surprise in the inflation front. Or, there could be structural causality from higher returns today to higher growth in the future. Higher stock returns could increase the demand for consumption and investment goods due to the wealth effect of an increase in stock prices. To understand all these effects and the interaction with the stock market and real economic activity, we need a dynamic model.

Furthermore, a VAR model that includes both stock market returns and real economic activity variables is consistent with intertemporal and factor asset pricing theories, which imply time-varying expected returns. In such a case, the lagged variables in the VAR system serve as proxy for the economic state variables that drive the changing expected returns.[3]

[3]Recent endogenous growth literature with financial intermediation, such as Greenwood and Jovanovic (1990), which implies rich interactive dynamics between financial variables and the real economy, also make VAR modeling more appealing. In such a framework, both financial variables and growth variables are endogenous, economic growth deepens financial intermediation, and the efficiency and higher returns in the financial market attract more people into the intermediation and

5.2 Implications From Consumption Based CAPM

Asset pricing models can be summarized by the following equation,

$$1 = E_t(R_{j,t+1}M_{t+1}), \tag{3}$$

if we assume that the no-arbitrage condition holds. Here, $R_{j,t+1}$ is the return to asset j from time t to $t+1$, and M_{t+1} is a stochastic discount factor. Any asset pricing model is simply a particular way to model the stochastic discount factor. $E_t(.)$ denotes conditional expectation given information up to time t. In CCAPM, M_{t+1} would represent the marginal rate of substitution between present and next-period consumption.

For example, in the asset pricing model of Lucas (1978), we have

$$1 = E_t(R_{j,t+1}M_{t+1}) = E_t(\frac{P_{t+1}+Y_{t+1}}{P_t}\beta\frac{u'(C_{t+1})}{u\prime(C_t)}) \tag{4}$$

where P_t is the stock price, and Y_t is the dividend, which equals output in the Lucas (1978) model. In equilibrium, we have $C_t = Y_t$. A constant relative risk aversion utility is usually assumed in the literature, as follows:

$$u(C) = \frac{C^{1-\alpha}}{1-\alpha},$$

which gives us:

$$1 = E_t(R_{t+1}\beta(\frac{Y_{t+1}}{Y_t})^{-\alpha}) \tag{5}$$

Assume R_{t+1} and $G_{t+1} = \frac{Y_{t+1}}{Y_t}$ are joint-lognormal distributed conditional on the current information set and are homoskedastic,[4] then the product $R_{t+1}M_{t+1}$ is also conditional lognormal. Further, because of our log normal assumptions, we have the

lead to faster economic growth.

[4]Conditional homoskedasticity is not a crucial assumption here, as long as one assumes that the conditional variances and covariances depend linearly on state variables in the current information set, as in the GARCH or Factor GARCH setting.

following exact relationship:

$$
\begin{aligned}
0 &= logE_t(R_{t+1}M_{t+1}) = E_t\{log(R_{t+1}M_{t+1})\} + \frac{1}{2}var_t\{log(R_{t+1}M_{t+1})\} \\
&= E_tr_{t+1} + log\beta - \alpha E_tg_{t+1} + \frac{1}{2}(V_{rr} + \alpha^2V_{gg} - \alpha V_{rg}) \qquad (6)
\end{aligned}
$$

where $r_t = logR_t$, $g_t = log\frac{Y_{t+1}}{Y_t}$, and V_{gg}, V_{rr}, and V_{rg} are the variances and covariance of g and r. Since we assume homoskedasticity, the variances and covariance are constant.

The Lucas (1978) model is an aggregate model that can be interpreted as imposing a restriction on the joint stochastic process of output growth g_t and the market return r_t. For asset pricing purposes, one usually specifies the stochastic process of g_t as exogenous, as in Lucas (1978) and Abel(1988), and makes predictions for the stock market return r_t. In this case, one writes the above equation as:

$$
\begin{aligned}
E_tr_{t+1} &= -log\beta + \alpha E_tg_{t+1} - \frac{1}{2}(V_{rr} + \alpha^2V_{gg} - \alpha V_{rg}) \\
&= Const_1 + \alpha E_tg_{t+1} \qquad (7)
\end{aligned}
$$

As pointed out by Cochrane (1991), in equation (6), if we fix or model the return process r_t exogenously and make predictions about consumption or output, then equation (6) would be a theory about consumption or income, as in the permanent income hypotheses. In such a situation, one may want to write:

$$
\begin{aligned}
E_tg_{t+1} &= \frac{log\beta}{\alpha} + \frac{1}{2\alpha}(V_{rr} + \alpha^2V_{gg} - \alpha V_{rg}) + \frac{1}{\alpha}E_tr_{t+1} \\
&= Const_2 + \frac{1}{\alpha}E_tr_{t+1} \qquad (8)
\end{aligned}
$$

But there is no general equilibrium theory that models both the stock return r_t and output growth g_t endogenously at the same time. In the growth literature, Greenwood and Jovanovic (1990) (GJ) model both the level of financial intermediation and economic growth endogenously, but the returns in the intermediated sector are assumed to be exogenous ($r_t = \theta_t + \epsilon_t$, with $E_{t-1}(\epsilon) = 0$ and the distribution of θ_t,

$F(\theta_t)$, is time invariant), and the expected growth rate from t-1 to t (as measured by the expected return earned across individuals) is a nonlinear but increasing function of $E_{t-1}r_t$. This implies that the higher the expected stock market return, the higher the expected growth, a result shared by the preceding equations.

Lacking a general equilibrium model in which both stock market returns and output growth are endogenously determined, we can view a VAR model that includes both stock returns and output growth as an empirical investigation about the underlying dynamics. We assume that the expected output growth g_{t+1} at time t can be written as a linear function of the variables in the current information set I_t, which includes the lagged values of g_t as well as r_t. Note that, from the permanent income hypothesis theory (Equation 6) and the results of the GJ model, it is natural that lagged returns r_{t-i} enter the equation for $E_{t-1}g_t$, as long as one assumes an autoregressive process for r_t. Besides, from the asset pricing theory (Equation 3), one can easily see that the current stock price is a function of expected future output growth; thus, current asset return is a forecasting variable for growth and should be included in the equation of $E_t g_{t+1}$. We therefore specify:

$$E_t g_{t+1} = c_y + \phi_1(L)g_t + \phi_2(L)r_t + \phi_3(L)z_t, \tag{9}$$

where $\phi_i(L)$, $i = 1, 2, 3$ are lag operators, and z_t are other information variables relevant for predicting output growth.

With this specification, the CCAPM Equation (6) will give us a restricted VAR that includes both r_t and g_t:

$$\begin{aligned} r_t &= c_r + \alpha c_y + \alpha\phi_1(L)g_t + \alpha\phi_2(L)r_t + \alpha\phi_3(L)z_t + \epsilon_{r,t} \\ g_t &= c_y + \phi_1(L)g_t + \phi_2(L)r_t + \phi_3(L)z_t + \epsilon_{y,t}, \end{aligned} \tag{10}$$

where c_y and c_r are constants. We see that cross-equation restrictions are placed on the coefficients of the lag variables.

5.3 Test of Restrictions on the VAR

Before using (10) for our empirical analysis of Korea's stock market, we conducted a likelihood ratio test of the coefficient restrictions in (10). We found that the p-value of the estimated statistics is less than 0.001, indicating that the restrictions can be rejected at a stringent significance level. In the test, other predictive variables in vector z_t included in the regressions are ΔInf_t, ΔM_t, and $\Delta Dcrd_t$. The rejection comes from the fact that the unrestricted regression of r_t has a much higher R^2 (65%) than the restricted R^2, which is only 1%. Thus, there is substantial variation in expected returns which cannot be explained by the restricted VAR implied by CCAPM. This result is not surprising since the CCAPM equation (4) is only a single factor model and is derived under a set of restrictive assumptions.

Because of this test result, we use the unrestricted version of the VAR model for the variance decomposition analysis in the following section.

6 Variation of Monthly Expected and Unexpected Returns: Variance Decomposition by a VAR Model

In this section, we consider a variance decomposition of monthly expected and unexpected returns in Korea's stock market. We start with equation (10), without the coefficient restrictions, and expand it by deriving more details about the error terms $\epsilon_{r,t}$ and $\epsilon_{y,t}$–the unexpected returns.

6.1 The Present Value Representation

To identify the meaningful components of these unexpected returns, we apply the approximate present value relation with time-varying expected returns developed by Campbell (1991) and Campbell and Shiller (1988) to express unexpected real return as follows:

$$\epsilon_{r,t+1} = r_{t+1} - E_t r_{t+1} = \eta_{d,t+1} - \eta_{r,t+1}, \tag{11}$$

$$\eta_{d,t+1} = (E_{t+1} - E_t) \sum_{j=0}^{\infty} \rho^j \Delta d_{t+1+j}, \tag{12}$$

$$\eta_{r,t+1} = (E_{t+1} - E_t) \sum_{j=1}^{\infty} \rho^j r_{t+1+j}, \tag{13}$$

where ρ is a parameter less than one determined by the dividend-price ratio[5] and d is the log dividend D. Note that $(E_{t+1} - E_t)Z = E_{t+1}Z - E_t Z$.

Equation (11) comes from an identity restriction. It says that unexpected stock returns must be equal to the present value of the revision in expected future dividends minus the present value of the revision of future expected returns.

Thus, *ex post* stock returns can be expressed as

$$r_{t+1} = E_t r_{t+1} + \eta_{d,t+1} - \eta_{r,t+1}. \tag{14}$$

That is, the *ex post* stock return is equal to the *ex ante* expected return, plus the change in expectations of future dividends growth, minus the change in expectations of future returns. We can interpret $\eta_{d,t+1}$ as news or shocks to dividend growth and $\eta_{r,t+1}$ as news about expected returns.

Since the revisions in expectations $\eta_{d,t+1}$ and $\eta_{r,t+1}$ are not directly observable, we estimate them from a VAR model which contains real returns, industry output growth, and other relevant variables.

[5]The average annual dividend yield is 4% annually in the sample period, this translates into a value of 0.996 for the monthly ρ. For a detailed discussion about the calibration of ρ, see Campbell, Lo and Mackinlay (1994).

We discuss the specification of the VAR model next. Here we need another transformation to relate the dividend news to economic fundamentals. In many intertemporal asset pricing models, such as Lucas (1978), dividend growth is proportional to industry growth. We assume that revision of the expectation about future dividend growth is proportional to the revision of the expectation of future industry growth rate plus a noise term, as follows:

$$(E_{t+1} - E_t)\Delta d_{t+1+j} = \gamma(E_{t+1} - E_t)g_{t+1+j} + \xi_{t+1+j}, \tag{15}$$

where g is as defined in section 3. ξ_{t+1+j} is a noise which is orthogonal to $(E_{t+1} - E_t)g_{t+1+j}$. Hence,

$$\eta_{d,t+1} = \gamma\eta_{g,t+1} + \eta_{\xi,t+1} = \eta_{dg,t+1} + \eta_{\xi,t+1}, \tag{16}$$

and, with equation (14), we have

$$r_{t+1} = E_t r_{t+1} + \gamma\eta_{g,t+1} - \eta_{r,t+1} + \eta_{\xi,t+1}. \tag{17}$$

Thus the volatility of stock returns can be decomposed into the variation in expected returns, the variation in the revision of expected returns, the variation in the revision of future cash flow growth due to the change in expectation of future industry output growth, an unexplained component, and the covariances between them.

6.2 Variance Decomposition By a VAR

We can represent our model as the following first-order VAR process:

$$y_{t+1} = Ay_t + \omega_{t+1}, \tag{18}$$

where y_t is a $n \times 1$ vector,

$$y_t = \{r_t, g_t, \text{and other relevant variables}\}'$$

and ω_{t+1} is the random shock to vector y_{t+1} at $t+1$, A is a $n \times n$ matrix of coefficients. Note that any higher order VAR process can be rewritten as a first-order VAR process.

With the preceding specification of the VAR, the revisions in the expected real returns and expected industry growth can be easily calculated using the fact that

$$(E_{t+1} - E_t)y_{t+1+j} = A^j \omega_{t+1}, \tag{19}$$

where $(E_{t+1} - E_t)y_{t+1+j}$ is the one-period revision in expected $(j+1)$-period ahead y. A^j is the j-th power of A.

Assume e_1 and e_2 are the first two columns of a $n \times n$ identity matrix. Then

$$(E_{t+1} - E_t)r_{t+1+j} = e_1' A^j \omega_{t+1} \tag{20}$$

$$(E_{t+1} - E_t)g_{t+1+j} = e_2' A^j \omega_{t+1} \tag{21}$$

$$r_{t+1} - E_t r_{t+1} = e_1' \omega_{t+1}. \tag{22}$$

Thus

$$\eta_{r,t+1} = (E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j r_{t+1+j} = e_1' \rho A (I - \rho A)^{-1} \omega_{t+1} \tag{23}$$

$$\eta_{g,t+1} = (E_{t+1} - E_t)\sum_{j=0}^{\infty} g_{t+1+j} = e_2' (I - A)^{-1} \omega_{t+1} \tag{24}$$

$$\epsilon_{t+1} = r_{t+1} - E_t r_{t+1} = e_1' \omega_{t+1} \tag{25}$$

$$\eta_{d,t+1} = \epsilon_{t+1} + \eta_{r,t+1}. \tag{26}$$

Using values of ϵ_{t+1}, $\eta_{d,t+1}$, and $\eta_{g,t+1}$ calculated from the estimated VAR model, we can estimate γ by OLS using equation (16) and the unexplained noise can thus be calculated by

$$\eta_{\xi,t+1} = \epsilon_{t+1} - \gamma \eta_{g,t+1} + \eta_{r,t+1}. \tag{27}$$

6.3 Estimation Results and Implications

6.3.1 Specification of the VAR

As we have argued earlier, we utilize an unrestricted VAR model to capture the rich dynamics in the data. Endogenous growth models with financial intermediation (such as the GJ model) suggest that other financial variables, such as credit variables, vary endogenously with industry growth; in addition, stock returns are correlated closely with future industry growth. To some extent, future industry growth can also be predicted through other variables in the economy, such as money supply, domestic credit, and inflation. Since dividends and future cash flows are closely connected to future industry growth, investors also would like to include these variables in their information set. Thus, in addition to real stock market returns and industry growth, we include inflation, domestic credit growth, and total money supply in the VAR.

We build a monthly VAR model. The five variables included in the VAR are defined as follows:

$$y_t = \{r_t, g_t, \Delta Inf_t, \Delta M_t, \Delta Dcrd_t\}',$$

Unit roots tests reveal that monthly stock price, industrial output, inflation rate, total domestic credit, and total money supply have unit roots. The estimated Dickey-Fuller (1979) test statistics are -1.39 for RI_t, -2.01 for Y_t, -1.54 for π_t, -2.35 for $Dcrd_t$, and -1.18 for M_t. At the 5% significance level (the critical value is -2.89), we cannot reject the null of unit roots. However, stock returns, industry output growth, changes in monthly inflation rate, changes in domestic credit, and changes in total money supply are stationary. The estimated Dickey-Fuller statistics are -9.73 for r_t, -13.86 for g_t, -9.00 for ΔInf_t, -3.28 for $\Delta Dcrd_t$, and -11.36 for ΔM_t. Thus, the null of unit roots can be rejected at the 5% level for those variables included in the VAR. A residual-based cointegration test for the stock market price index, index of industry output, inflation rate, domestic credit, and total money supply cannot reject the null of no cointegration. The estimated Phillips and Ouliaris (1990) statistic is -3.87 under the null hypothesis of no cointegration. The critical value at the 5% level is -4.45, and at the 10% level is -4.16; thus, the null cannot be rejected at both levels.

Therefore, all the variables in y_t are taken to be stationary, and the VAR estimated is:

$$y_{t+1} = C + \sum_{j=1}^{N} A_j y_{t+1-j} + \omega_{t+1} \tag{28}$$

where C is a vector of constants, A_j is a $n \times n$ matrix of coefficients of y_{t+1-j}.

The corresponding first-order VAR representation is

$$Y_{t+1} = Const. + AY_t + \Omega_{t+1}, \tag{29}$$

where

$$Y'_{t+1} = \{y_{t+1}, y_t, y_{t-1}, \ldots, y_{t-N+2}\} \tag{30}$$

$$A = \begin{bmatrix} A_1 & A_2 & A_3 & \ldots & A_{N-1} & A_N \\ \mathrm{I} & 0 & 0 & \ldots & 0 & 0 \\ 0 & \mathrm{I} & 0 & \ldots & 0 & 0 \\ \ldots & \ldots & \ldots & \ldots & \ldots & \ldots \\ 0 & 0 & 0 & \ldots & \mathrm{I} & 0 \end{bmatrix} \tag{31}$$

$$\Omega'_{t+1} = \{\omega_{t+1}, 0, \ldots, 0\} \tag{32}$$

$$Const.' = \{C, 0, 0, \ldots, 0\} \tag{33}$$

6.3.2 The Variation of Expected Returns: Implications

The order of the VAR determined by likelihood ratio tests is 18. The R^2s for the estimated equations shown in Table 4.

Equations	r_t	g_t	ΔInf_t	ΔM_t	$\Delta Dcrd_t$
R^2	0.65	0.75	0.78	0.64	0.78
Adjusted R^2	0.19	0.43	0.49	0.19	0.50

Table 4: R^2s and Adjusted R^2s for the VAR Equations

For the monthly return equation, we see that R^2 is 0.65, and the adjusted R^2 is 0.19. The relatively low adjusted R^2, compared to R^2, reflects the fact that many lagged variables in the VAR have little or no predictive power for monthly stock returns in Korea. But the adjusted R^2 is significantly higher than what we find in the literature for the US market. It is interesting to compare the numbers. As reported by Chen (1991), Fama (1990a), and Fama and French (1988, 1989), in the US, the predictable component in monthly returns is only about 7% to 14%. This suggests that for the Korean stock market, a relatively larger part of the variation in stock returns is due to the variation in expected stock returns.

We conducted F-tests on the null hypothesis that the lags of each variable in each equation have zero coefficients to see the significance of these lags in predicting the right-hand side variables. The results are shown in Tables 5 and 6.

Equation	Excluding	F-stat	Signif.Level
r_t	r_t	2.14	0.013
	g_t	2.43	0.004
	ΔInf_t	1.84	0.037
	ΔM_t	1.30	0.219
	$\Delta Dcrd_t$	1.66	0.069
g_t	r_t	1.20	0.290
	g_t	2.93	0.001
	ΔInf_t	0.86	0.629
	ΔM_t	1.66	0.070
	$\Delta Dcrd_t$	2.26	0.008

Table 5: F-tests, Excluding the Lags of Each Variable in Equations r_t and g_t

We focus our attention to the return r_t and industry growth g_t equations (Table 5). As we see in the simple OLS regression analysis in section 4, stock returns are correlated positively with future economic growth. Two explanations can account for this observation. First, as implied by asset pricing models, stock returns are forecasts of future economic activities. If future economic growth is expected to be higher, current stock returns are also higher. The direction of structural causality is from g_{t+j} to r_t, and r_t merely contains information in the existing information about future economic growth. Second, there could be structural causality from r_t to g_{t+j}. Higher returns today will cause higher economic growth in the future. The question is, can we distinguish between the two possibilities? Are stock market returns a mere leading indicator for future economic activity or can they cause changes in future economic activity? The VAR results provide clues to these questions.

Equation	Excluding	F-stat	Signif.Level
ΔInf_t	r_t	1.60	0.084
	g_t	1.28	0.231
	ΔInf_t	4.53	0.000
	ΔM_t	0.89	0.589
	$\Delta Dcrd_t$	2.11	0.014
ΔM_t	r_t	1.62	0.078
	g_t	1.98	0.023
	ΔInf_t	0.92	0.554
	ΔM_t	1.06	0.406
	$\Delta Dcrd_t$	0.29	0.998
$\Delta Dcrd_t$	r_t	1.98	0.022
	g_t	1.89	0.032
	ΔInf_t	1.67	0.068
	ΔM_t	2.45	0.004
	$\Delta Dcrd_t$	2.32	0.007

Table 6: F-tests, Excluding the Lags of Each Variable in Equations ΔInf_t ,ΔM_t and $\Delta Dcrd_t$

First, as conjectured in the previous sections, if the current stock return is correlated with future economic activity, then those lagged variables that can predict future economic growth should also be able to predict current stock returns. In the equation for r_t, we see that lagged changes in the inflation rate, lagged changes in credit, and lagged industry growth rates are all significant in predicting current returns. Also, lagged changes in credit and lagged industry growth rates are powerful forecasting variables for industry output growth. This finding suggests that the predictable component in Korean stock returns does vary with changing economic conditions.

Second, if returns are just leading indicators for future economic activity and they contain future industry growth information which is also contained in other state variables, then, after we include these state variables in the regression of g_{t+1} on the information set I_t, lagged returns should no longer be significant. But if stock returns have some unique information which is orthogonal to the information in other included variables, or if stock returns can actually cause additional economic growth in the future, then we would expect lagged returns to remain significant in forecasting industry growth, even in the presence of other state variables. From the F-tests for equation g_t, we see that it does not seem that r_t has any additional forecasting power for g_t, and the structural causality from r_t to g_{t+j} is doubtful.

Third, we see that lagged changes in inflation are also significant (at the 5% level) in forecasting real returns. Fama (1990b) and many others have found that real stock returns are correlated with both expected and unexpected inflation. Since lagged ΔInf_t can predict ΔInf_t, it is not surprising that lagged ΔInf_t can predict real return r_t.

Fourth, the equation for r_t shows that lagged returns are also significant in predicting current returns. Since lagged returns do not contain additional information about future industry growth in the presence of the other lagged variables, one possible explanation for this is market inefficiency. But it could be also due to the fact that real returns are correlated with inflation rates (both expected and unexpected). Since lagged returns are significant (at the 10% level, though) in predicting changes in inflation ΔInf_t, lagged returns would have marginal forecasting power for the current return because they contain some additional information about future inflation.

To summarize, our empirical analysis indicates that expected returns in the Korean stock market vary with a set of macroeconomic variables, and the predictable component is substantial. We also have found that current returns are correlated with lagged returns even when conditioned on the presence of other economic state variables. On the issue of market efficiency, it is shown that the same set of economic state variables as proxied by the lagged variables in the VAR system can both predict real economic activity and real returns, and current market returns correlate positively with future real economic growth. We would interpret our evidence demonstrating the positive correlation as simply a result of the forecasting behavior of the market. There is no evidence for structural causality from current stock returns to future industry growth.

We next turn to the analysis of unexpected returns.

6.3.3 The Variation of Unexpected Returns: Variance Decomposition

In section 6.1 we saw that unexpected stock market returns $\epsilon_{t+1} = r_{t+1} - E_t r_{t+1}$ can be written as the sum of three components: news about future expected returns $\eta_{r,t+1}$, news about future cash flows captured by industry output growth $\gamma\eta_{g,t+1}$, and a noise term $\eta_{\xi,t+1}$. To look at the relative importance of each item in the variation of unexpected returns, from equation (14) we have

$$Var(\epsilon_{t+1}) = Var(\eta_{r,t+1}) + Var(\eta_{d,t+1}) - 2Cov(\eta_{r,t+1}, \eta_{d,t+1}), \tag{34}$$

where $\eta_{d,t+1}$ can be written as–see (16):

$$\eta_{d,t+1} = \gamma\eta_{g,t+1} + \eta_{\xi,t+1}$$

$$\equiv \eta_{dg,t+1} + \eta_{\xi,t+1}$$

Note that $\eta_{dg,t+1}$ represents the news about future dividends as captured by the news in industry output growth. We will refer to $\eta_{\xi,t+1}$ as the news about dividends which is not related to the news about industry growth. Thus,

$$\begin{aligned} Var(\epsilon_{t+1}) &= Var(\eta_{r,t+1}) + Var(\eta_{dg,t+1}) + Var(\eta_{\xi,t+1}) \\ &- 2Cov(\eta_{r,t+1}, \eta_{dg,t+1}) - 2Cov(\eta_{r,t+1}, \eta_{\xi,t+1}) \end{aligned} \tag{35}$$

(By specification, the covariance between $\eta_{dg,t+1}$ and $\eta_{\xi,t+1}$ is zero.)

The covariance and correlation matrix for ϵ_t, $\eta_{r,t}$ and $\eta_{d,t}$ is[6]

$$VCV1 = \begin{array}{c} \\ \epsilon_t \\ \eta_{r,t} \\ \eta_{d,t} \end{array} \left[\begin{array}{ccc} \epsilon_t & \eta_{r,t} & \eta_{d,t} \\ \hline 0.0028 & -0.0008 & 0.0021 \\ -0.27 & 0.0031 & 0.0024 \\ 0.60 & 0.65 & 0.0044 \end{array} \right]$$

The numbers below the diagonal are corresponding correlations, those above the diagonal are covariances, those on the diagonal are variances.

While the variance of monthly unexpected return is about 0.28%, the variances of the news about expected returns and dividend growth are 0.31% and 0.44%, respectively. Note that, the unconditional covariance between unexpected returns and news about expected returns is negative, with the correlation equal to -0.27. Campbell and Shiller (1988) show that conditioned on dividend news, the correlation between unexpected returns and news about expected returns is negative. But the unconditional covariance can go either way. We also find that the covariance between the news about dividend growth and the news about expected returns is positive, with

[6]Another way of looking at the relative importance of each component in the variation of unexpected returns is to look at the R^2s of simple regressions of the unexpected return on each component $\eta_{r,t+1}$, $\eta_{dg,t+1}$, and $\eta_{\xi,t+1}$. The R^2s of these regressions will be related directly to the simple correlations between the relevant variables in $VCV1$.

the correlation higher at 0.65. So, if the market revises expectation of future dividend growth upward, it also introduces an upward revision on expected returns. The variation of unexpected stock returns is highly correlated with the news about the dividend growth, with a correlation coefficient of 0.60.

The following equation projects the news of the dividend growth to the news of future industry output growth:

$$\eta_{d,t+1} = \underset{(23.5)}{3.35} \quad \eta_{g,t+1} + \eta_{\xi,t+1} \qquad R^2 = 0.78$$

The t-statistic ($t = 23.5$) and the R^2 ($= 0.78$) show that this projection is highly significant. Thus, although we cannot observe the market's revision in expectation of future dividend growth directly, we can estimate a large part of the revision by the news in the expected industry output growth from our VAR model.

Setting $\eta_{dg,t+1} = 3.35 * \eta_{g,t+1}$, and $\eta_{\xi,t+1} = \eta_{d,t+1} - \eta_{dg,t+1}$, we obtain the following covariance and correlation matrix:

$VCV2 =$

	ϵ_t	$\eta_{r,t}$	$\eta_{dg,t}$	$\eta_{\xi,t}$
ϵ_t	0.0028	-0.0008	0.0004	0.0016
$\eta_{r,t}$	-0.27	0.0031	0.0030	-0.0006
$\eta_{dg,t}$	0.13	0.92	0.0034	0.0000
$\eta_{\xi,t}$	0.96	-0.34	0.0000	0.0010

Note again that the numbers below the diagonal are corresponding correlations, those above the diagonal are covariances, with the variances on the diagonal.

We see that there is higher correlation (0.92) between news about expected returns and dividend-related industry growth news. Although the correlation between unexpected returns and dividend news is higher at 0.60 (see the equation of $VCV1$), the correlation between unexpected returns and dividend-related industry growth news is only 0.13, while the correlation between unexpected returns and the dividend news unrelated to industry output is higher at 0.96. These results indicate that only a small portion of the variation in unexpected Korean stock market returns is related to the variation in economic fundamentals.

7 Conclusions and Future Research

This paper investigates the relationship between economic fundamentals and variations in stock returns in Korea. Starting from an intertemporal consumption-based CAPM (CCAPM), we obtain a restricted VAR model for stock returns and macroeconomic variables. We then apply this model to Korea and find statistically significant departures from the restrictions implied by CCAPM.

Consequently, an unrestricted VAR model is used to analyze the variations of expected and unexpected returns in the Korean stock market. It is shown that the expected market returns vary with a set of macroeconomic variables, and that the predictable component is substantial. Reflecting richer dynamics in the data, relative to the usual single equation modeling in the literature, the estimated VAR model shows considerable predictive ability for both real economic activity and real returns. It is also found that current returns are correlated with lagged returns even when conditioned on the presence of other economic state variables. On the issue of market efficiency, it is shown that the same set of economic state variables as proxied by the lagged variables in the VAR system can both predict real economic activity and real returns, and current market returns correlate positively with future real economic growth. This empirical evidence demonstrates that the positive correlation is simply a result of the forecasting behavior of the market, and there is no evidence for structural causality from current stock returns to future industry growth.

In decomposing of unexpected stock returns, we find that, although we cannot directly observe the market's revision in expectation of future dividend growth, we can estimate a large part of the revision by the news in the expected industry output growth from our VAR model. Our empirical evidence based on a correlation analysis of the components of unexpected stock returns in Korea suggests that economic fundamentals can explain only a small portion of the variation in unexpected Korean stock returns.

It would be interesting to further investigate why there is serial correlation in market returns, even after controlling for economic state variables, while at the same time, economic fundamental news has little effect on unexpected returns. One possible explanation is that, because of the heavy regulation in the Korean financial system, the market could not react to news promptly, and it takes time for the market to absorb shocks from fundamentals. Thus, event-study type research and the investigation into market micro-structure could be useful in explaining the behavior of both expected and unexpected returns.

8 References

1. Abel, A. B. (1988) "Stock Prices Under Time-Varying Dividend Risk-An Exact Solution in an Infinite-Horizon General Equilibrium Model". *Journal of Monetary Economics*, 22: 375-393.

2. Campbell, J. Y. (1991) "A Variance Decomposition of Stock Returns, the H.G. Johnson Lecture to the Royal Economic Society". *Economic Journal*, 101: 157-179.

3. Campbell, J. Y. and J. Ammer (1993) "What Moves the Stock and Bond Markets? A Variance Decomposition for Long-Term Asset Returns". *The Journal of Finance*, XLVIII, NO.1: 3-37.

4. Campbell, J. Y. and R. J. Shiller. (1988) "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors". *Review of Financial Studies*, 1: 195-228.

5. Campbell, J., A. Lo, and C. MacKinlay (1994). "Models of the Term Structure of Interest Rates." Federal Reserve Bank of Philadelphia Working Paper No. 94-10 (May).

6. Chen, N. F. (1991) "Financial Investment Opportunities and the Macroeconomy". *The Journal of Finance*, XLVI (2).

7. Cheung, Y. W., J. He, and L. Ng. (1994) "Pacific-Basin Stock Markets and Real Activity". *Pacific-Basin Finance Journal*, 2: 349-373.

8. Cochrane, J. H. (1991) "Production-Based Asset Pricing and the Link Between Stock Returns and Economic Fluctuations". *The Journal of Finance*, XLVI (1).

9. Dickey, D. A. and W. A. Fuller. (1979) "Distribution of the Estimators for Autoregressive Time Series with a Unit Root". *Journal of the American Statistical Association*, 74: 427-431.

10. Estrella, A. and G. A. Hardouvelis. (1991) "The Term Structure as a Predictor of Real Economic Activity". *Journal of Finance*, XLVI (2).

11. Fama, E. F. (1981) "Stock Returns, Real Activity, Inflation and Money". *American Economic Review*, 71: 545-565.

12. Fama, E. F. (1986) "Term Premiums and Default Premiums in Money Markets". *Journal of Financial Economics*, 17: 175-196.

13. Fama, E. F. (1990a) "Stock Returns, Expected Returns and Real Activity". *Journal of Finance*, 45: 1089-1108.

14. Fama, E. F. (1990b) "Term-Structure Forecasts of Interest Rates, Inflation, and Real Returns". *Journal of Monetary Economics*, 25: 59-76.

15. Fama, E. F. and K. R. French. (1988) "Dividend Yields and Expected Stock Returns". *Journal of Financial Economics*, 22: 3-25.

16. Fama, E. F. and K. R. French. (1989) "Business Conditions and Expected Returns on Stocks and Bonds". *Journal of Financial Economics*, 25: 23-49.

17. Fama, E. F. and G. W. Schwert. (1977) "Asset Returns and Inflation". *Journal of Financial Economics*, 5: 115-146.

18. Geske, R. and R. Roll. (1983) "The Monetary and Fiscal Linkage between Returns and Inflation". *Journal of Finance*, 38: 1-33.

19. Greenwood, J. and B. Jovanovic. (1990) "Financial Development, Growth, and the Distribution of Income". *Journal of Political Economy*, 98(5): 1076-1107.

20. Kaul, G. (1987) "Stock Returns and Inflation: the Role of the Monetary Sector", *Journal of Financial Economics*, 18: 253-276.

21. Lucas, Jr.,R. (1978) "Asset Prices in an Exchange Economy". *Econometrica*, 46: 1429-1445.

22. Phillips, P. C. B. and S. Ouliaris. (1990), "Asymptotic Properties of Residual Based Tests for Cointegration". *Econometrica*, 58: 190.

23. Schwert, G. W. (1990) "Stock Returns and Real Activity: A Century of Evidence". *Journal of Finance*, 45: 1237-1257.