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ABSTRACT

This paper studies the relation between changes in financial investment opportunities and changes in the macroeconomy. States variables such as the lagged production growth rate, the default premium, the term premium, the short-term interest rate and the market dividend-price ratio are shown to be indicators of recent and future economic growth. Further, the market excess return is negatively correlated with recent economic growth and positively correlated with expected future economic growth. These results offer straightforward interpretations of recent evidence on the forecasts of the market excess return by state variable via their forecasts on the macroeconomy.

IN A MULTIPERIOD ECONOMY, investors have an incentive to hedge against future stochastic shifts in the consumption and investment opportunity set (see Fama (1970)). This implies that state variables that are correlated with changes in consumption and investment opportunities are priced in capital markets in the sense that an asset's covariance with those state variables affects its expected returns (see Cox, Ingersoll, and Ross (1985) and Merton (1973)).

Empirically, there is considerable evidence that state variables such as aggregate production growth, yield spreads between low grade and high grade bonds, yield spreads between long- and short-term government bonds, short-term interest rates, and dividend yields are important in explaining the asset pricing equilibrium and useful in forecasting returns of stocks and

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bonds.[1] Since general equilibrium models suggest that characteristics of the macroeconomy should be related to asset returns, it is important to know whether these state variables are related to the macroeconomy in a way consistent with their forecasts of asset returns. This is the purpose of our study.[2]

After reviewing the evidence on how these variables forecast the stock market premium (i.e., return in excess of the riskless rate), we proceed in three parts. In the first part, we relate the state variables to the recent and future growth rates of economic activity. In the second part, we relate the growth rates of economic activity to the expected market premium. Our main hypothesis is that the expected market premium is negatively related to the recent growth of economic activity (proxying for the health of the current economy) and positively related to the expected future growth of economic activity and its conditional variance.[3] In the third part, we reinterpret the evidence on the forecast of the market premium by the state variables in terms of their ability to forecast economic activity.

We find that the state variables are indeed related to changes in the macroeconomy. The current market dividend yield and a measure of the default premium (the difference between the yields on a composite corporate bond portfolio and Aaa bonds) are indicators of the current health of the economy as measured by the recent growth rate of GNP (and consumption). The current short-term interest rate, the current term structure (as measured by the difference in yield between long-term and short-term government bonds), and the lagged industrial production growth rate forecast changes in the future growth rates of GNP (and consumption). In addition, there is also some evidence relating the state variables to the conditional variance of the GNP growth rate.

When we use realized and expected GNP growth rates to forecast the market premium, the evidence is consistent with our hypothesis that the market premium is negatively related to the recent growth rate and posi-

[1]Chen, Roll, and Ross (1986) and Chan, Chen, and Hsieh (1985) find that changes in aggregate production, inflation, the short-term interest rates, the slope of term structure (as measured by the return difference between long-term and short-term government bonds), and the risk premium (as measured by the return difference between low grade bonds and high grade bonds) are important economic factors in determining equilibrium expected returns on securities. In time-series analyses, Fama and Schwert (1977), Rozeff (1984), Keim and Stambaugh (1986), Campbell (1987), Fama and Bliss (1987), and Fama and French (1988a,b, 1990) find that short-term interest rates, expected inflation, dividend yields, yield spreads between long- and short-term government bonds, yield spreads between low grade bonds and high grade bonds, and lagged stock price ratios (or returns) can predict the expected returns of bonds and stocks.

[2]We have also examined the relation between the changes in relative prices and the state variables, but we decided to defer the discussion of the results concerning the relations between financial state variables and the changes in the consumption opportunities to a future study.

[3]This is the conjecture proposed in Chen, Roll, and Ross (1986) and Chan, Chen, and Hsieh (1985, p. 454). Fama and French (1990) also suggest that expected returns are functions of business conditions.

tively related to the expected future growth rate.[4] Direct forecasts of the market premium by the state variables are also consistent with the joint evidence on how state variables forecast economic activity and how economic activity in turn forecasts the market premium.

The remainder of the paper is divided into six sections. Section I defines the state variable used. Section II documents that the state variables forecast the market premium. Section III examines the relation between the state variables and the recent and future growth rates of GNP and the conditional variance of the growth rates. Section IV examines how the recent and future growth rates of GNP and the conditional variance of the growth rates forecast the market premium. Section V interprets the forecasting power of the states variables for the market premium in terms of their ability in forecasting economic activity. Section VI concludes the paper.

I. The State Variables

In this section, we define and motivate the choice of the state variables used in this study.

A. Industrial Production

We used *lagged* production growth over the previous 12 months as an indicator of the current health of the economy:

$$YPL_{t-1} = \log\left[IP(t-1)/IP(t-13)\right],$$

where $IP(t)$ is the level of seasonally unadjusted industrial production for month t.[5]

The length of 12 months in measuring the growth rate is somewhat arbitrary. Using a shorter period would imply that the measured growth rate reflects short-term production fluctuations rather than the health of the current economy relative to long-term growth. With a longer period, the growth rate might miss a business cycle altogether. We hope that our choice of the length of 12 months, which allows us to use *seasonally unadjusted* data, is sufficiently informative about the current health of the economy.[6]

[4]Chan (1989) finds that the conditional variance of production growth is also an important determinant of the expected market premium before World War II. Over our sample period from 1954 to 1986, however, the relation between the expected market excess return and our measure of the conditional variance of the growth of GNP is weak.

[5]The change in YPL from $t-1$ to t is equal to $\log[\mathrm{IP}(t)/\mathrm{IP}(t-1)] - \log[\mathrm{IP}(t-12)/\mathrm{IP}(t-13)]$. The first term of this expression is the same as the definition of the monthly growth rate of production (for month $t-1$) used in the Chen, Roll, and Ross (1986) to measure the production risk.

[6]Seasonally unadjusted data avoid the use of future data in the seasonal adjustment. This consideration is important when the constructed variable is used for extracting ex ante expectations.

B. The Term Structure

Under rather general assumptions, the term structure of interest rates is related to the expected growth rates of GNP and consumption. The intuition is straightforward. If future output is expected to be high, individuals desire to smooth consumption by attempting to borrow against the expected future production, thereby bidding up interest rates. Theoretically, this relation is implied by the first-order conditions for the utility maximization problem of a representative consumer (see, e.g., Rubinstein (1976), Lucas (1978), and Breeden 1986)). In this study, we use a single yield spread variable UTS to summarize the term structure:

$$UTS_{t-1} = (\textit{Average } 10\textit{-year government bond yield})_{t-1} - TB_{t-1}$$

where the average 10-year government yield (Citibase) is the average of the yields observed in the last month of quarter $t-1$ (in quarterly and annual regressions) and TB_{t-1} is the one-month T-bill rate at the beginning of the first month of quarter t. We call UTS the term spread variable.

C. T-bill Rate

Short-term interest rates also fluctuate with economic conditions. Fama and French (1990) observe that T-bill rates tend to be low in a business contraction, especially at the low turning points of business cycles. The T-bill rate we use, TB_{t-1}, is the implied one-month rate observed at the beginning of quarter t (CRSP file).

D. The Default Spread

The risk premium implicit in the pricing of securities is affected by the health of the economy. We capture it with the default spread, UPR, defined as

$$UPR_{t-1} = (\textit{Composite Corporate Bond Yield})_{t-1} - (\text{Aaa } \textit{Bond Yield})_{t-1}$$

This variable is the same as the one used in Fama and French (1990). The Composite Corporate Bond Yield is the average of 100 corporate bond yields (Ibbotson & Associates) observed at the end of quarter $t-1$.[7] The Aaa (Moody's rating) Bond Yield is the average of the Aaa yields observed at the end of quater $t-1$.

The above four state variables correspond to the economic factors in Chen, Roll, and Ross (1986). To measure the risk of the economic factors, Chen, Roll, and Ross use the "innovations" rather than the "levels" of these variables. For example, in measuring term structure risk, they use the return difference between long- and short-term government debt (which is the change in the yield spread, properly normalized) rather than the yield

[7] I am grateful to Roger Ibbotson for providing the data.

spread (the difference in the implied internal rates of return which is more appropriate for predicting expected returns and premiums).

E. The Dividend Yield

By design, the variables in the Chen, Roll, and Ross study are chosen outside of the equity market to model stock returns as functions of macroeconomic variables and nonequity asset returns.[8] However, the results in Fama and French (1988b, 1990) show that stock market returns are predicted better by a variable constructed from the same market, the dividend yield variable, defined as

DP_{t-1} = the ratio of dividends on the value-weighted NYSE portfolio for the year ending in quarter $t-1$ to the value of the portfolio at the end of quarter $t-1$.

The purpose of including this variable is to examine how the dividend yield (by itself and in conjunction with the other variables) is related to the recent and future growth rates of GNP and consumption as well as the future market returns.

F. The Macroeconomic Variable and the Market Returns

The quarterly growth rates of GNP and consumption are defined as

$$GNPG_t = \log\left[GNP(t)/GNP(t-1)\right],$$

$$CONSUMG_t = \log\left[CONSUM(t)/CONSUM(t-1)\right],$$

where GNP(t) and CONSUM(t) are seasonally adjusted GNP and per capita total real consumption in quarter t, respectively (Citibase). The real market return RVW is the continuously compounded return of the value-weighted NYSE index in excess of inflation. The excess market return (i.e., the market premium), EVW, is the continuously compounded return of the value-weighed NYSE index in excess of the Treasury Bill rate.

Our sample test period is 1954–86. Construction of the state variables (e.g., the lagged production growth) uses observations up to one year prior to the test period. The starting date, similar to those in Fama and Schwert (1977), Chen, Roll, and Ross (1986), and Fama (1990), avoids the interest-rate-pegging period before the Treasury-Federal Reserve Accord.

The means, standard deviations, autocorrelations and correlations of these variables are reported in Table I and II. The correlations are computed using nonoverlapping annual observations. We compute four separate correlations for each pair of variables (e.g., March to March, June to June, September to September, and December to December), and the average over the four correlations is reported as the average correlation in Table II.

[8]Of course, in a full general equilibrium model all economic variables are endogenous. In a test of Ross (1976), Chen, Roll, and Ross take the stock market as endogenous "relative" to other markets.

Table I

Summary Statistics—Annual Observations (1954-1986)

YP is yearly industrial production (seasonally unadjusted) growth. UPR is the end-of-year yield difference between Ibbotson's composite corporate bond yield and Aaa (Moody's) yield (annualized). UTS is the difference between the average December yield (annualized) on 10-year government bonds (Citibase) and TB, the end of the year one-month Treasury Bill rate (annualized). DP is the ratio of dividends on the value-weighted NYSE portfolio for the previous year to the value of the portfolio at the end of the previous year. GNPG is the growth rate of real GNP from quarter four of year t − 1 to quarter four of year t. CONSUMG is the growth rate of per capita real consumption from quarter four of year t − 1 to quarter four of year t. RVW is the continuously compounded real value-weighted NYSE index return. EVW is the continuously compounded value-weighted NYSE index return in excess of the 12-month Treasury Bill rate (Fama and Bliss (1987)).

			Autocorrelations			
	Mean	S.D.	1	2	3	4
YP	0.0341	.0601	.01	−.36	−.03	−.02
UPR	0.0055	.0029	.40	.26	−.04	.05
UTS	0.0088	.0120	.43	.05	−.14	.01
TB	0.0537	.0274	.81	.61	.50	.45
DP	0.0384	.0088	.63	.45	.51	.51
GNPG	0.0291	.0248	.13	−.20	−.14	−.12
CONSUMG	0.0218	.0195	.27	−.34	−.08	−.00
RVW	0.0662	.1798	−.02	−.31	.12	.34
EVW	0.0534	.1795	−.08	−.34	.12	.34

II. The Power of State Variables in Forecasting Market Returns

Although the main goal of this study is to interpret how market returns are related to state variables via their forecasts of economic activity, we begin by investigating how future real and excess market returns are related to the state variables.[9] The regressions of real and excess value-weighted NYSE returns in successive future quarters on the currently observable state variables are reported in Tables III, Panels A and B. (The two panels are similar.) Consistent with previous findings, the dividend yield variable *DP* (over similar periods) forecasts real and excess market returns over the next 2 years, though its forecasting power diminishes toward the end of the second year. Among the other state variables, the default spread UPR is most similar to DP in terms of its power to forecast future market returns. The "strength" of its forecasting power, however, is weaker than that of DP, and it starts to fade beyond the first year. If we were forecasting excess low grade bond returns rather than excess market returns, the relative predictive

[9]Many of the results here are consistent with those reported in earlier studies of the predictability of market returns.

Table II

Average Correlations (1954–1986)

The average correlations are the average of the correlations computed using March–March, June–June, September–September, December–December annual observations. For the March 1954 observation, YP is the 12-month industrial production (seasonally unadjusted) growth ending in March 1954. UPR is the March 1954 yield difference between Ibbotson's composite corporate bond yield and Aaa (Moody's) yield (annualized). UTS is the March 1954 difference (annualized) of average yield on 10-year government bonds (Citibase) and TB, the end of March 1954 one-month Treasury Bill rate (annualized). DP is the ratio of dividends on the value-weighted NYSE portfolio for the previous 12-month to the value of the portfolio at the end of March 1954. GNPG is the growth rate of real GNP and CONSUMG is the growth rate of per capita real consumption from quarter 1 of 1953 to quarter 1 of 1954. RVW is the annual continuously compounded real value-weighted NYSE index return and EVW is the continuously compounded annual value-weighted NYSE index return in excess of the 12-month Treasury Bill rate (Fama and Bliss (1987)) realized at the end of March 1954.

	YP	UPR	UTS	TB	DP	GNPG	CONSUMG	RVW
UPR	−.50							
UTS	−.13	.08						
TB	−.07	.25	−.33					
DP	−.40	.51	.03	.55				
GNPG	.92	−.52	−.09	−.08	−.44			
CONSUMG	.75	−.48	.12	−.14	−.45	.80		
RVW	.27	−.01	.30	−.27	−.31	.23	.36	
EVW	.25	−.07	.23	−.01	−.24	.22	.34	.94

"strength" between DP and UPR would be reversed (not reported here but consistent with the evidence in Fama and French (1990)).

The forecasting ability of the term spread UTS on stock market returns appears to fade much more quickly (as it forecasts further into the future) than DP or UPR. The forecasting power of TB is limited to the next quarter. Finally, the lagged annual production growth YPL— serving as a proxy for the current health of the economy— exhibits forecasting power over the next 4 quarters. The negative slope coefficients indicate that the poorer the health of the current economy, the higher the expected return.[10] This result is intuitive. In a depressed state of the economy when the consumption rate is relatively low, an investor can be induced to forego a marginal unit of consumption in favor of risky investments only if their expected returns are relatively high.

The evidence relating bond returns to the state variables is generally similar to that for stock returns, and therefore it is not reported here. The only exception, as mentioned above, is that the relative "strength" of the forecasting power of DP and UPR is reversed. Overall, the results indicate that the state variables that are found to be important in explaining equilibrium cross-sectional relations between risk and return have power to forecast

[10]Rather than using the lagged production growth, we also used a detrended production variable to forecast stock returns. The results are similar to that of YPL.

future real and excess returns of stocks (and bonds). Since the results for the forecasts of real returns are similar to those for excess returns, we discuss only the results corresponding to excess returns in the remainder of this paper.

Table III

Univariate Regressions of Future Quarterly Market Return on State Variables (1954 Q1-1986 Q4)

This table presents the slope coefficient (b) and *t*-ratio (in parentheses) with R^2 for the corresponding regression. RVW is the continuously compounded quarterly real value-weighted NYSE index return. EVW is the continuously compounded quarterly excess value-weighted NYSE index return. DP is the ratio of dividends on the value-weighted NYSE portfolio for the previous 12 months to the value of the portfolio at the end of the quarter. UPR is the end of the quarter yield difference between Ibbotson's composite corporate bond yield and Aaa (Moody's) yield (annualized). UTS is the (annualized) average end of the quarter yield on 10-year government bonds (Citibase) and TB, the end of the quarter one-month Treasury Bill rate (annualized). YPL is the industrial production (seasonally unadjusted) growth over previous 12 months observed at the end of the quarter.

Panel A. Real Market Return Regressions

$$(\text{RVW})_t = a + b\,(\text{STATE VARIABLE})_{t-\text{lag}} + e_t$$

	State Variable				
Lag	DP	UPR	UTS	TB	YPL
1	2.208	6.462	2.010	−0.416	−0.327
	(2.98)	(2.61)	(3.07)	(−1.86)	(−2.78)
	0.05	0.05	0.09	0.02	0.06
2	2.771	8.050	1.535	−0.291	−0.324
	(3.69)	(3.25)	(2.24)	(−1.19)	(−2.87)
	0.08	0.07	0.05	0.01	0.06
3	2.386	4.895	1.286	−0.177	−0.308
	(3.15)	(1.79)	(1.92)	(−0.76)	(−3.28)
	0.06	0.02	0.03	0.00	0.05
4	2.193	5.324	0.604	−0.051	−0.199
	(2.69)	(2.23)	(0.87)	(−0.23)	(−2.17)
	0.05	0.03	0.00	−0.01	0.02
5	2.123	4.722	−0.201	0.084	−0.042
	(2.67)	(1.81)	(−0.29)	(0.37)	(−0.43)
	0.05	0.02	−0.01	−0.01	−0.01
6	1.912	4.944	0.041	0.033	0.081
	(2.29)	(1.96)	(0.06)	(0.14)	(0.82)
	0.04	0.02	−0.01	−0.01	0.00
7	1.519	3.893	−1.097	0.245	0.097
	(1.86)	(1.59)	(−2.04)	(1.25)	(0.98)
	0.02	0.01	0.02	0.00	0.00
8	1.094	3.369	−0.471	0.085	0.112
	(1.34)	(1.32)	(−0.71)	(0.38)	(1.09)
	0.01	0.01	0.00	−0.01	0.00

Table III—*Continued*

Panel B. Excess Market Return Regressions
$(EVW)_t = a + b\,(\text{STATE VARIABLE})_{t-\text{lag}} + e_t$

Lag	DP	UPR	UTS	TB	YPL
	State Variable				
1	2.125	5.583	1.855	−0.473	−0.322
	(2.86)	(2.22)	(2.85)	(−2.14)	(−2.75)
	0.04	0.03	0.08	0.03	0.06
2	2.637	6.990	1.393	−0.353	−0.317
	(3.48)	(2.77)	(2.07)	(−1.46)	(−2.87)
	0.07	0.05	0.04	0.01	0.05
3	2.261	3.866	1.145	−0.236	−0.294
	(3.00)	(1.39)	(1.70)	(−1.03)	(−3.21)
	0.05	0.01	0.02	0.00	0.05
4	2.032	4.252	0.506	−0.123	−0.182
	(2.53)	(1.78)	(0.73)	(−0.56)	(−2.01)
	0.04	0.01	−0.00	−0.01	0.01
5	1.928	3.410	−0.260	0.008	−0.024
	(2.43)	(1.31)	(−0.38)	(0.04)	(−0.25)
	0.04	0.01	−0.01	−0.01	−0.01
6	1.696	3.784	0.046	−0.051	0.102
	(2.02)	(1.50)	(0.06)	(−0.21)	(1.04)
	0.03	0.01	−0.01	−0.01	−0.00
7	1.274	2.658	−1.093	0.160	0.116
	(1.56)	(1.09)	(−2.02)	(0.83)	(1.18)
	0.01	0.00	0.02	−0.00	0.00
8	0.836	2.238	−0.383	−0.012	0.128
	(1.02)	(0.87)	(−0.56)	(−0.05)	(1.27)
	0.00	−0.00	−0.00	−0.01	0.00

III. State Variables as Indicators of Economic Activity

Since financial assets are claims against the output of the economy, changes in the macroeconomy are reflected in the financial investment opportunity set. In this section, we relate the state variables to the recent and expected future growth rates of economic activity.

The regressions of the quarterly growth rate of GNP over successive past and future quarters on the state variables are reported in Table IV. The similarity between DP and UPR is apparent. We find that an above average DP or UPR observed at the end of quarter $t-1$ indicates that the growth of GNP from quarter $t-4$ to $t-1$ has been lower than average, and the growth from quarter $t-1$ to $t+1$ is also expected to be below average.[11]

[11]This is consistent with the results in Table II on correlations. There we find that DP and UPR are both negatively correlated with YP, the annual production growth rate ending in the same month in which DP and UPR are observed.

The DP and UPR do not have any forecasting power for the future growth rate of GNP beyond quarter $t + 1$. Thus, both DP and UPR are indicators of the current health of the economy, but they are not informative about the future health.[12]

In contrast, the term spread UTS has little correlation with past GNP growth rates, but it has forecasting power for future growth rates of GNP up

Table IV

Univariate Regressions of Quarterly Growth Rate of GNP on State Variables (1954 Q1-1985 Q4)

This table presents the slope coefficient (b) and t-ratio (in parentheses) with R^2 for the corresponding regression. Growth rate at t + lead is the growth rate from quarter t + lead − 1 to quarter t + lead. DP is the ratio of dividends on the value-weighted NYSE portfolio for the previous 12 months to the value of the portfolio at the end of the quarter. UPR is the end of the quarter yield difference between Ibbotson's composite corporate bond yield and Aaa (Moody's) yield (annualized). UTS is the (annualized) average end of the quarter yield on 10-year government bonds (Citibase) and TB, the end of the quarter one-month Treasury Bill rate (annualized). YPL is the industrial production (seasonally unadjusted) growth over previous 12 months observed at the end of the quarter.

$$(\text{Growth Rate})_{t+\text{lead}} = a + b\,(\text{STATE VARIABLE})_{t-1} + e_t$$

	State Variable				
Lead	DP	UPR	UTS	TB	YPL
−4	−0.189	−1.047	−0.083	−0.009	0.076
	(−1.65)	(−3.51)	(−0.85)	(−0.23)	(7.15)
	0.02	0.07	0.00	−0.01	0.20
−3	−0.324	−1.241	−0.152	0.004	0.113
	(−2.62)	(−3.66)	(−2.04)	(0.10)	(14.29)
	0.06	0.10	0.03	−0.01	0.47
−2	−0.432	−1.512	0.017	−0.027	0.113
	(−3.84)	(−4.71)	(0.23)	(−0.60)	(14.33)
	0.12	0.16	−0.01	0.00	0.47
−1	−0.463	−1.406	0.033	−0.030	0.093
	(−4.03)	(−4.32)	(0.44)	(−0.83)	(7.41)
	0.14	0.13	−0.01	0.00	0.32
0	−0.438	−1.253	0.253	−0.083	0.039
	(−3.72)	(−3.35)	(3.34)	(−2.39)	(2.51)
	0.12	0.11	0.09	0.06	0.05
1	−0.276	−1.036	0.321	−0.099	−0.006
	(−2.38)	(−2.38)	(4.96)	(−3.04)	(−0.42)
	0.05	0.07	0.15	0.09	−0.01
2	−0.056	−0.085	0.336	−0.096	−0.022
	(−0.46)	(−0.20)	(4.63)	(−3.01)	(−1.73)
	−0.01	−0.01	0.16	0.08	0.01

[12] In other words, lower current levels of GNP are associated with lower stock and corporate bond prices, thereby leading to higher DP and UPR.

Table IV—*Continued*

	State Variable				
Lead	DP	UPR	UTS	TB	YPL
3	0.013	0.090	0.265	−0.077	−0.025
	(0.09)	(0.18)	(3.03)	(−2.13)	(−2.11)
	−0.01	−0.01	0.10	0.05	0.02
4	0.042	0.287	0.249	−0.067	−0.028
	(0.30)	(0.58)	(3.35)	(−1.81)	(−2.23)
	−0.01	0.00	0.09	0.04	0.02
5	0.023	0.250	0.134	−0.033	−0.024
	(0.16)	(0.65)	(1.67)	(−1.01)	(−1.55)
	−0.01	0.00	0.02	0.00	0.02
6	0.025	0.362	0.094	−0.017	−0.020
	(0.16)	(0.87)	(1.50)	(−0.44)	(−1.34)
	−0.01	0.00	0.01	−0.01	0.01
7	−0.048	0.288	0.010	−0.002	−0.013
	(−0.31)	(0.72)	(0.13)	(−0.04)	(−0.88)
	−0.01	0.00	−0.01	−0.01	0.00

to 5 quarters ahead.[13] As discussed previously there is an obvious relation between the term structure and the future level of economy activity, and it is not surprising to find that an above average term spread forecasts an above average growth rate of GNP up to 5 quarters ahead. The reason why the current T-bill rate can forecast changes in the growth rate of GNP over the next 4 quarters is less obvious. Lower T-bill rates may reflect lower expected inflation, and the lower inflation expectation may in turn reflect information indicating higher future economic growth (see Fama (1981, 1990) and Litterman and Weiss (1985)). Another possibility is that lower expected implicit inflation taxes on corporate cash flows (see Feldstein (1982)) may induce higher economic growth in the future.

The most intriguing predictive pattern is associated with YPL, the recent production growth variable. The last column of Table IV indicates that YPL is positively correlated with the growth rate of GNP only up to quarter t, suggesting that there is only a small amount of persistence in the growth rate. Future GNP growth rates start to turn around beyond quarter $t + 2$. This negative correlation pattern may be peculiar to this sample period, but, for the purpose of interpreting the results in this paper, we regard the pattern as a reflection of the true forecasting ability of YPL on future GNP growth.

Table V presents the regressions of the N-period growth rates from quarter $t - 1$ to quarter $t - 1 + N$ on the state variables observed at the end of

[13] Estrella and Hardouvelis (1991) present regression results similar to ours.

Table V

Univariate Regressions of N-Quarter Growth Rate and Conditional Uncertainty of GNP on State Variables (1954 Q1-1985 Q4)

This table presents the slope coefficient (b) and *t*-ratio (in parentheses) with R^2 for the corresponding regression. N-Quarter growth rate at t is the growth rate from quarter t − 1 to quarter t + N − 1. DP is the ratio of dividends on the value-weighted NYSE portfolio for the previous 12 months to the value of the portfolio at the end of the quarter. UPR is the end of the quarter yield difference between Ibbotson's composite corporate bond yield and Aaa (Moody's) yield (annualized). UTS is the (annualized) average end of the quarter yield on 10-year government bonds (Citibase) and TB, the end of the quarter one-month Treasury Bill rate (annualized). YPL is the industrial production (seasonally unadjusted) growth over previous 12 months observed at the end of the quarter. Conditional uncertainty at t is the square of the residual of regressing the 4-quarter growth rate from quarter t − 1 to quarter t − 3 on five independent variables: DP, UPR, UTS, TB and YPL, all observed at the end of quarter t − 1.

$$(\text{N-Quarter Growth Rate})_t = a + b\,(\text{STATE VARIABLE})_{t-1} + \epsilon_t$$

	State Variable				
N	DP	UPR	UTS	TB	YPL
1	−0.438[a]	−1.253	0.252	−0.083	0.039
	(−4.08)	(−3.42)	(3.16)	(−2.65)	(2.49)
	0.12	0.11	0.09	0.06	0.05
2	−0.714	−2.289	0.573	−0.182	0.033
	(−3.55)	(−3.17)	(4.97)	(−3.18)	(1.15)
	0.13	0.14	0.18	0.11	0.01
3	−0.770	−2.375	0.910	−0.278	0.011
	(−2.68)	(−2.26)	(5.59)	(−3.48)	(0.29)
	0.08	0.08	0.26	0.16	−0.01
4	−0.757	−2.284	1.175	−0.355	−0.015
	(−1.95)	(−1.60)	(5.29)	(−3.42)	(−0.36)
	0.05	0.05	0.31	0.18	−0.01
5	−0.715	−1.998	1.424	−0.422	−0.043
	(−1.44)	(−1.09)	(5.63)	(−3.33)	(−0.99)
	0.04	0.03	0.36	0.20	0.00
6	−0.692	−1.747	1.558	−0.455	−0.067
	(−1.13)	(−0.84)	(5.55)	(−3.05)	(−1.36)
	0.03	0.02	0.36	0.19	0.01
7	−0.667	−1.385	1.653	−0.472	−0.087
	(−0.92)	(−0.62)	(5.69)	(−2.72)	(−1.53)
	0.02	0.00	0.35	0.18	0.02
8	−0.715	−1.097	1.663	−0.474	−0.100
	(−0.85)	(−0.47)	(5.80)	(−2.35)	(−1.58)
	0.02	0.00	0.31	0.16	0.02
	$(\mathit{Conditional\ Uncertainty})_t = a + b(\mathit{STATE\ VARIABLE})_{t-1} + \eta_t$				
	0.013	0.048	−0.002	0.004	−0.0017
	(1.93)	(2.44)	(−0.21)	(1.97)	(−1.98)

[a]These are quarterly regressions, and the standard errors are adjusted using the Newey and West (1987) method.

quarter $t - 1$. The results are also plotted in Figure 1. The plots in Figure 1 are "mean-adjusted" in the sense that if a state variable does not have power to predict the future growth of GNP, the plot for that variable would remain flat at the zero level (representing the "mean-adjusted" growth rate of GNP). From Figure 1, the predictive patterns of the state variables are apparent. An above average dividend yield DP, or default spread UPR, forecasts lower than average growth rate up to 2 quarters ahead, but neither has any power to forecast changes in the growth rate beyond that point. On the other hand, an above average term spread UTS, or a below average T-bill rate TB, forecasts that the GNP level will continue to increase over the next 4 to 6 quarters. Finally, an above average production growth in the past forecasts that GNP growth will be lower than average in the next 2 to 6 quarters.

We are also interested in finding out whether the state variables have any forecasting power for the conditional variance of the GNP growth rate. Since

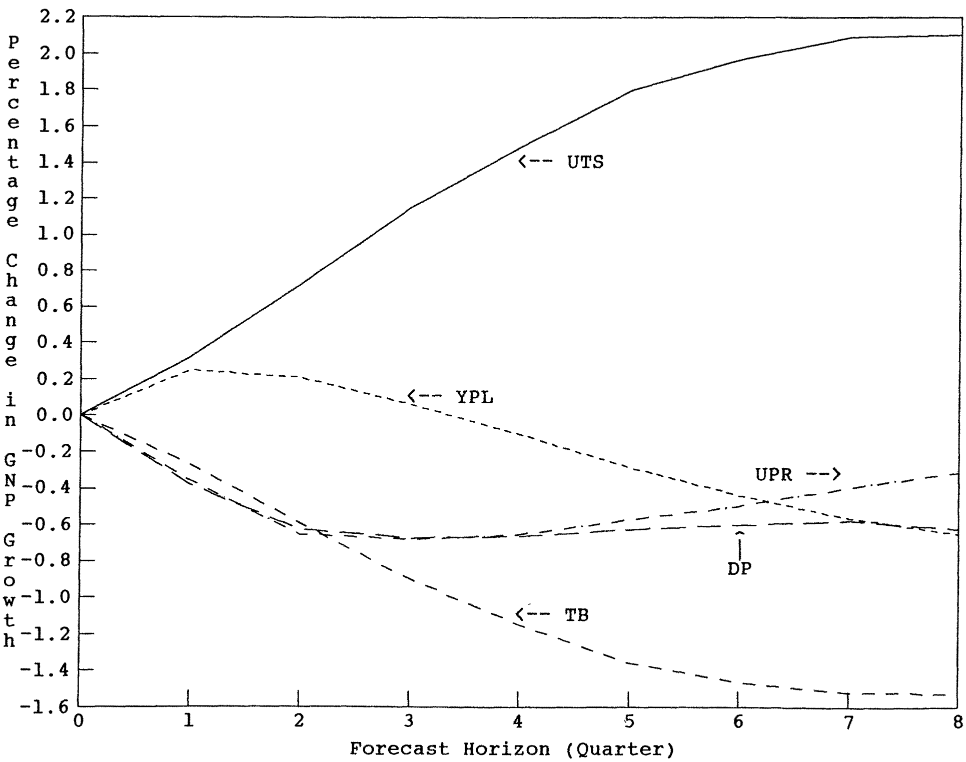

Figure 1. Change in GNP Growth per Standard Deviation Increase in State Variables. DP is the ratio of dividends of the value-weighted NYSE portfolio for the previous 12 months to the value of the portfolio at the end of the quarter. UPR is the end of the quarter yield difference between Ibbotson's composite corporate bond yield and Aaa (Moody's) yield (annualized). UTS is the (annualized) average end of the quarter yield on 10-year government bonds (Citibase) and TB, the end of the quarter 1-month Treasury Bill rate (annualized). YPL is the industrial production (seasonally unadjusted) growth over previous 12 months observed at the end of the quarter.

there is no agreement on what is the best equation for the growth rate forecast, all five variables, DP, UPR, UTS, TB, YPL, are included as independent variables forecasting the future N-period growth rate. The residual-square is then employed as an estimate of the conditional variance of the growth rate.[14] The bottom of Table V presents univariate regression results of regressing the estimated conditional variance of the 4-quarter growth rate on each of the state variable.[15] All state variables except the term spread have some power to forecast the conditional variance. An above average DP, UPR, or TB forecasts higher conditional variance (and lower growth). An above average YPL, being an indicator of the current health of the economy, forecasts lower conditional variance. However, the results are not statistically strong, and it appears that the conditional variance of growth rate of GNP is only marginally related to the state variables.

The corresponding results for forecasting growth rates of per capita consumption are similar to those for the growth rates of GNP, with the only exception that the conditional consumption variance is not related to any state variable. (Results are available from the author upon request). We also examined the corresponding results for forecasting growth rates of corporate cash flows (the sum of after tax retained earnings and cash dividends), and the results were similar to those for GNP.

Overall, the regression analysis of this section indicates that an above average DP (dividend-yield) or UPR (default spread) is associated with lower than average growth in GNP (and consumption) in the recent and the immediate future quarters. An above average UTS (slope of the term-structure) or below average TB (one-month T-bill rate) is associated with higher than average growth of GNP (and consumption) in the next 4 to 6 quarters. An above average past production growth YPL is associated with higher current (and past) growth of GNP and consumption, but the growth rates are expected to reverse in the next 3 to 6 quarters. There is also some evidence relating the state variables to the conditional variance of the future GNP growth.

IV. Expected Returns and Economic Activity

A. A Brief Review of Theoretical Issues

Lucas (1978), Brock (1982), and Cox, Ingersoll, and Ross (1985), among others, model the relation between asset prices and characteristics of the macroeconomy. In these models, the equilibrium prices, and hence expected returns, are functions of state variables that describe the macroeconomy such as the past and current production rates, the expected productivity of capital

[14]An attempt to fit an ARIMA model to the time series of the estimated conditional variance of the quarterly growth was unsuccessful because of the lack of obvious "time-series properties."

[15]The state variables do not have any discernible power to forecast the conditional variance beyond the fourth quarter ahead.

and the uncertainty of the production technology. In this section, we briefly discuss the intuition that motivates our main hypotheses.

In both single period asset pricing models, such as Sharpe (1964), Linter (1965), as well as multiperiod models such as Merton (1973), Rubinstein (1976), Breeden (1979) and Cox, Ingersoll, and Ross (1985), the risk premium of the market is a positive function of the aggregate risk aversion parameter. Suppose, for example, the aggregate utility of consumption is represented by a HARA class utility function,

$$u(c) = a(c - \hat{c})^{1-\alpha}/(1 - \alpha), \tag{1}$$

where $\alpha \geq 0$ is a constant, the relative risk-aversion coefficient is

$$\begin{aligned} RRA &= -\frac{u''(c) \cdot c}{u'(c)} = \frac{\alpha \cdot c}{(c - \hat{c})} \\ &= \frac{\alpha}{1 - \hat{c}/c}. \end{aligned} \tag{2}$$

If we interpret $\hat{c}$ as the subsistence level of consumption, then as $c \downarrow \hat{c}$, RRA $\to \infty$. In other words, in a depressed state where consumption is low, relative risk aversion, and hence the market's risk premium, tends to be high. One can model the subsistence level $\hat{c}$ as an exogenous parameter that grows at the rate of per capita consumption, or one can endogenize $\hat{c}$ through habit formation.[16] In the latter case, equation (2) would not be the appropriate measure of RRA since the future utility of consumption depends on both current as well as past consumption, thereby breaking the link between RRA and current consumption. Nevertheless, the same intuition that the relative risk aversion tends to be high in a depressed state still applies (see Constantinides (1990, Section 2 and 3)). Thus, if we use the lagged growth rate of the economy as a proxy for the current health of the economy, we would expect its correlations with expected market returns and premiums to be negative.

Secondly, since financial securities are claims against output, a change in the productivity of capital generally affects expected returns. For example, in a simple economy with stochastic constant-returns-to-scale (see, e.g., Cox, Ingersoll, and Ross (1985)), a higher productivity of capital leads to a higher expected market return.[17] At the same time, individuals would want to smooth consumption by attempting to borrow against expected future outputs, thereby bidding up interest rates. Thus, higher expected future levels of economic activity will generally lead to higher expected stock and bond returns. The impact on the *excess* expected stock market return, however, may depend on the parameters of the model.

[16]See, for example, Sundaresan (1989), Constantinides (1990), Detemple and Zapatero (1990) and the references in those papers.

[17]A constant-returns-to-scale technology is simple and sufficient but not necessary. See Lucas (1978) and Brock (1982).

Abel (1988), extending the analysis of Barsky (1989) in a Lucas (1978)-type economy, derives the following expression (his equation (38a)) for the expected market premium:

$$E_t\{R_{t+1} - R^F_{t+1}\} = h(\mu_t, \nu_t)\, y_t^{-\alpha}, \tag{3}$$

where μ_t is the expected future level of production (also equal to consumption or dividends in his model), ν_t is a measure of the volatility of future production, h is a function that depends on the relative risk aversion parameter α (Abel equation (38b)), and y_t is the most recent level of production. In the simple case where the utility function is ln C, the expected market return, the risk-free rate, and the expected market premium all have simple expressions proportional to the expected future level of production μ_t:

$$E_t(R_{t+1}) = \beta^{-1}(\mu_t / y_t)$$

$$R^F_{t+1} = \beta^{-1}(\mu_t / y_t) \cdot \left(1 + \nu_t^2\right)^{-1}$$

and

$$E_t\left(R_{t+1} - R^F_{t+1}\right) = \beta^{-1}(\mu_t / y_t)\frac{\nu_t^2}{1 + \nu_t^2}, \tag{4}$$

where β is the time preference parameter. In this case, a higher level of expected future production leads to both a higher expected market return and a higher expected market premium.

Finally, equation (4) suggests that the expected market premium is also increasing in the conditional volatility of production growth.[18] In most general equilibrium models of asset pricing with production, prices of financial assets depend on the conditional production volatility.[19]

The above discussion motivates the following hypotheses relating the expected market premium to the characteristics of the macroeconomy:

(1) The risk aversion implicit in the pricing of financial securities, and hence the expected market premium, are negatively correlated with a measure of the relative health of the current economy, such as the recent growth of the aggregate economy.

(2) Since financial securities are claims against future outputs, a measure of the future productivity of capital, such as the expected growth rate of

[18] Abel (1988), however, shows that this is not always true. He illustrates through a numerical example (where $\alpha = 6$) that the expected risk premium can be decreasing in the conditional volatility. See also Backus and Gregory (1988). Since French, Schwert, and Stambaugh (1987) find empirically that the expected risk premium is positively related to the conditional variance of stock returns, we also examine the relation between the expected market premium and the conditional variance of GNP growth. However, it should be noted that if the conditional variance of production growth (or conditional market return variance) is driven by the same state variables that describe the current and the expected future productivity of real capital, a separate (partial) correlation between the expected market premium and the conditional variance may not be observed in the same regression containing those variables.

[19] See, for example, Cox, Ingersoll, and Ross (1985) and Barsky (1989).

the aggregate economy, should be positively correlated with the expected market return and premium.

(3) The expected market premium is positively related to a measure of the conditional uncertainty of the production technology.

B. Expected Returns and Macroeconomic Variables: The Evidence

To examine the above hypotheses, we must first identify the time horizon to be used in measuring the recent and future aggregate growth of the economy. While our choice of using one-year growth rates is somewhat arbitrary, the results reported in this section are robust to alternative choices of the growth horizon.[20]

The recent growth rate of GNP at the end of quarter $t - 1$ is based on the average of the two annual growth rates ending in quarter $t - 1$ and quarter t. Quarter t is included here because all the state variables (observed at the end of $t - 1$) have forecasting power for the growth of GNP from $t - 1$ to t. Investors making investment decisions at the end of quarter $t - 1$ are likely to utilize the information (regarding the expected GNP next quarter) reflected in the state variables observed at the end of quarter $t - 1$ in assessing the current health of the economy. The future growth rate of GNP for the quarterly excess market return regressions is based on the annual growth from quarter $t - 1$ to quarter $t + 3$. The conditional GNP growth variance is based on the residual obtained from regressing the above future annual growth on the state variables (see footnote 21 or note d in Table VI. To be consistent with the quarterly excess market return regressions, the future growth rate of GNP for the annual excess market return regressions is based on the average of the four annual growth rates from quarter $t - 1$ to $t + 3$, t to $t + 4$, $t + 1$ to $t + 5$, and $t + 2$ to $t + 6$.

We use the fitted values of growth rates of GNP as explanatory variables in forecasting excess market returns. To avoid the "bias"of using information from previous regression results in selecting the specification of the first stage regression in this 2SLS, we always use all five independent variables: DP, UPR, UTS, TB, YPL, in the first stage regressions.[21] These regressions are reported in the footnotes of Table VI. The second stage regressions relating excess market returns to the fitted growth rates and growth variances of GNP are reported in Table VI. The standard errors are computed

[20] If we replace the fitted recent growth of GNP by the lagged annual growth of the seasonally unadjusted industrial production, results are similar. If we use more than 4 quarters ahead GNP to measure the future growth, results are also similar.

[21] The fitted conditional GNP growth variance is $\pi/2$ times the squared fitted value from the regression of the absolute residuals on the five state variables. Residuals are first obtained from regressing future GNP (quarter $t - 1$ to $t + 3$) on the same five variables. We thank Dan Nelson for insightful discussions on the relative merits of different ways to estimate the expected conditional variance. We use the same conditional GNP variance for quarterly and annual excess market return regressions (see footnotes 14 and 15).

using the method suggested in Pagan (1984) and Murphy and Topel (1985), taking into account the 2SLS.

Equations (Q1) to (Q3) show that future excess market returns are indeed negatively related to the current health of the economy (as proxied by the fitted recent GNP growth) and positively related to the expected future GNP growth. These relations are more reliable in (Q3) after the conditional GNP growth variance is dropped as an independent variable. The conditional GNP growth variance does not have much power to forecast future excess

Table VI

Multiple Regressions of Excess Value-Weighted Market Return on Fitted GNP Growth Rates and Conditional Uncertainty (1954-1986)[a]

The fitted growth rates of GNP are generated from regressions with the five predictive variables DP, UPR, UTS, TB and YPL. DP is the ratio of dividends on the value-weighted NYSE portfolio for the previous 12 months to the value of the portfolio at the end of the quarter. UPR is the end of the quarter yield difference between Ibbotson's composite corporate bond yield and Aaa (Moody's) yield (annualized). UTS is the (annualized) average end of the quarter yield on 10-year government bonds (Citibase) and TB, the end of the quarter one-month Treasury Bill rate (annualized). YPL is the industrial production (seasonally unadjusted) growth over previous 12 months observed at the end of the quarter.

	Fitted[b] Recent Growth of GNP	YPL	Expected[c] Future Growth of GNP	Conditional[d] GNP Growth Variance	Unexpected Future Growth of GNP	$\bar{R}^2$
	Panel A. Quarterly Regressions With Quarterly Observations					
(Q1)	−0.948		1.097	−1.35		0.098
	(−2.20)		(1.91)	(−0.02)		
(Q2)				31.30		−0.001
				(0.80)		
(Q3)	−0.941		1.104			0.105
	(−3.30)		(2.55)			
(Q4)	−0.941		1.104		1.235	0.190
	(−3.15)		(2.59)		(3.38)	
(Q5)		−0.316	0.892		1.235	0.171
		(−2.62)	(2.12)		(3.50)	
	Panel B. Quarterly Regressions With Annual Observations[e]					
(A1)	−2.599		4.945	28.39		0.307
	(−1.89)		(2.44)	(0.17)		
(A2)				163.2		0.029
				(1.07)		
(A3)	−2.785		4.527			0.313
	(−5.04)		(3.38)			
(A4)	−2.937		4.129		3.863	0.453
	(−4.42)		(3.24)		(2.91)	

Table VI—*Continued*

Panel B. Quarterly Regressions With Annual Observations[e]

	Fitted[b] Recent Growth of GNP	YPL	Expected[c] Future Growth of GNP	Conditional[d] GNP Growth Variance	Unexpected Future Growth of GNP	$\bar{R}^2$
(A5)		−0.999	3.673		3.838	0.409
		(−3.65)	(2.73)		(2.92)	

[a] t-statistics are in parentheses.

[b] Recent growth rate of GNP is the average of the growth of GNP from quarter t − 5 to t − 1 and the growth of GNP from quarter t − 4 to t. The fitted recent growth of GNP is based on (t-statistics in parentheses):

$$\text{GNP Growth}_t = \underset{(5.09)}{.033} + \underset{(3.09)}{0.246}\,\text{UTS}_{t-1} + \underset{(1.47)}{.051}\,\text{TB}_{t-1} - \underset{(-1.82)}{.401}\,\text{DP}_{t-1}$$

$$+ \underset{(17.85)}{.340}\,\text{YPL}_{t-1} - \underset{(-1.90)}{.991}\,\text{UPR}_{t-1} + e_t, \qquad \bar{R}^2 = 0.88.$$

[c] The future growth rate of GNP is the growth of GNP from quarter t − 1 to t + 3. The fitted value is based on:

$$\text{Future Growth}_t = \underset{(4.89)}{.057} + \underset{(3.74)}{1.04}\,\text{UTS}_{t-1} - \underset{(-0.95)}{0.10}\,\text{TB}_{t-1} - \underset{(-1.34)}{0.42}\,\text{DP}_{t-1}$$

$$- \underset{(-1.86)}{0.065}\,\text{YPL}_{t-1} - \underset{(-2.27)}{2.206}\,\text{UPR}_{t-1} + \upsilon_t, \qquad \bar{R}^2 = 0.40.$$

The unexpected future growth of GNP is the difference between the realized growth and the fitted growth obtained from the above equation.

[d] The residual from the above regression, υ_t, is defined as the unexpected future growth of GNP. The absolute value of the residual from the above regression is the dependent variable of the following regression:

$$\text{Absolute Residual}_t = \underset{(1.87)}{.011} + \underset{(.93)}{4.86}\,\text{UPR}_{t-1} - \underset{(-.08)}{.013}\,\text{DP}_{t-1} - \underset{(-1.42)}{0.27}\,\text{YPL}_{t-1}$$

$$- \underset{(-.05)}{.007}\,\text{UTS}_{t-1} + \underset{(1.56)}{.69}\,\text{TB}_{t-1} + \eta_t, \qquad \bar{R}^2 = 0.05.$$

The fitted conditional GNP growth variance is $\pi/2$ times the squared fitted value from the above regression.

[e] The future growth rate of GNP for the annual observations is the averaged growth of GNP from quarter t − 1 to t + 3, t to t + 4, t + 1 to t + 5, and t + 2 to t + 6. The fitted value is based on:

$$\text{Future Growth}_t = \underset{(3.28)}{.042} + \underset{(3.59)}{.82}\,\text{UTS}_{t-1} - \underset{(-1.34)}{.15}\,\text{TB}_{t-1} - \underset{(-0.24)}{0.08}\,\text{DP}_{t-1}$$

$$- \underset{(-3.08)}{0.083}\,\text{YPL}_{t-1} - \underset{(-0.99)}{0.907}\,\text{UPR}_{t-1} + \omega_t, \qquad \bar{R}^2 = 0.37.$$

The residual from the above regression, ω_t, is defined as the unexpected future growth of GNP. The slope estimates of the annual excess market return regression are the average OLS estimates from the four quarterly split sample regressions (i.e., regressions using annual observations beginning at the ith quarter, i = 1, 2, 3, 4). Next, the residuals are obtained by using these average OLS estimates on the full sample with the fitted growth replaced by the actual growth. Standard errors are then computed using these residuals, adjusted by the Newey and West (1987) method (see Huizinga (1984)).

market returns by itself (equation (Q2)) or in conjunction with the fitted growth rates (equation (Q1)).[22]

If we replace the fitted recent GNP growth rate by YPL, the lagged annual growth rate of industrial production in (Q1) and (Q3), the results (not reported here) are similar. If we replace the fitted future GNP growth rate by the actual future GNP growth rate, the actual future GNP growth rate is positively related to the future excess market return (not reported here, but similar to the results of Fama (1981, 1990) and Shah (1989)). Here, the realized market excess return may contain an unanticipated response of the market to the unexpected future growth of GNP. When we decompose the actual GNP growth rate into the expected and unexpected components (Q4), both components are reliably related to the future excess market return. Results are similar when we replace the fitted recent GNP growth in (Q4) by YPL as an independent variable (Q5).

In the next panel, instead of reporting quarterly results over successive future quarters, we summarize the results using quarterly regressions with annual observations ((A1) to (A5)). Results are largely similar to those corresponding to quarterly observations and indicate that the expected market premium is negatively related to the recent growth of the economy and positively related to the expected and unexpected future growth of the economy.[23]

V. The Relation between Predicting Macroeconomic Activity and Predicting Future Stock Market Returns: A First Look

We now consider collectively all the evidence presented above in order to relate the ability of the state variables in forecasting economic activity to their ability in forecasting expected market returns. The hypothesis providing the link is that the expected excess market return is negatively related to recent economic growth and positively related to future economic growth.

[22]The weak correlation between the market premium and the fitted conditional production variance may be due to the imprecision of the estimate of the conditional production variance. According to Table V the conditional production variance is negatively correlated with the lagged production growth. Thus, a possible explanation of the negative relation between market premium and lagged production may be ascribed to the negative relation between conditional production variance and lagged production.

[23]In equations (Q4) and (A4), the slope coefficients for the expected and the unexpected future GNP growths are about the same. This may provide a simple explanation for the observation by Fama (1990) that when the actual industrial production growth rates are included, a term structure variable loses its power to forecast future market return: since UTS is an important variable for predicting future GNP growth which is part of the actual future GNP growth, its forecasting power is captured by the actual future GNP growth when included in the same regression. These results (with GNP growth rather than industrial production growth) are available from the author.

A. Univariate Regressions

Univariate regressions are considered first. In this section, we relate how each state variable is correlated with the recent and future growth of GNP to how it forecasts the future excess market return. Since the regressions have already been presented in Tables III, IV, and V, we only need to interpret the results jointly.

We consider the lagged production growth variable first. The recent annual growth of production YPL is used as an indicator of the current health of the economy. If the past annual growth (not just the most recent month or quarter) is substantially below average, this indicator would suggest that the current health of the economy is relatively poor, and the consumption rate is low. Our hypothesis implies a high expected excess market return. Furthermore, a below average lagged production growth also forecasts that the future growth rate of GNP will be high in the next 2 to 5 quarters (Table IV), which also implies a high expected excess market return. Thus, the two predictive effects of YPL on expected excess market returns reinforce each other over the immediate future quarters. However, productions growth rates sufficiently far apart are negatively correlated (Table IV) which dampens both effects in the distant future quarters. As we observe from Table III, Panel B, the YPL has forecasting power up to 4 quarters in the future.

An above average dividend yield DP suggests that the current health of the economy is poor (Table IV) and that the economy will continue to deteriorate up to 2 quarters ahead. Beyond that, the forecasting power of DP on future growth of GNP diminishes. Combining this pattern with the reliable 4-quarter forecasts of YPL on expected excess market returns, it is interesting to note that the DP variable has reliable forecasting power for returns up to 6 quarters before it diminishes.[24] The evidence that an above average DP is simultaneously related to persistent bad times (Table IV) and subsequent high expected excess market return (Table III, Panel B) offers a straightforward interpretation of the ability of DP to forecast returns consistent with the habit-formation story. This interpretation is also consistent with the forecasting pattern of the default premium variable UPR which is similar to that of DP.

An above average term spread UTS forecasts higher GNP growth for the next 5 quarters. Since UTS alone is not significantly related to the recent change in production (the correlation between YP and UTS reported in Table II is -0.13), our hypothesis suggests a higher expected excess market return in the immediate future quarters. However, the higher GNP growth produces two offsetting effects in future quarters. For a given future quarter, the higher "current" level of GNP produces a lower expected excess market

[24]Note that over the first quarter, an above average DP forecasts that a poor current state will continue to deteriorate for another quarter. These two effects are offsetting. For the second future quarter, DP no longer forecasts a further deterioration of GNP growth, and thus only the poor "current" state effect is present. It is interesting to note that the forecasting power of DP reaches the maximum (coefficient, t-statistic, adjusted R-square) at the second future quarter.

return while the higher future growth of GNP (from that quarter on) produces a higher expected excess market return. When the future quarter is further away, the latter effect is weaker than the former since the level of "current" GNP is higher while the number of remaining quarters of expected higher GNP growth (predicted by UTS at the end of quarter $t - 1$) becomes smaller. This implies that the forecasting power of UTS for expected excess market returns deteriorates monotonically and rapidly, which is exactly what we observe in Panel B of Table III.

The behavior of TB is similar to (except for the sign) but weaker than that of UTS, both in terms of forecasting future GNP growth and expected excess market returns. As shown in Panel B of Table III, the power of TB to forecast expected excess market returns also diminishes quickly.

B. Multiple Regressions

Next, our hypotheses regarding the relation between the forecasts of GNP growth and the forecasts of expected excess market return are subjected to a more difficult test by examining them in a multiple regression framework. This poses an interesting challenge because variables with similar forecasting patterns for GNP growth in univariate regressions do not always carry the same information.[25] Thus, collinearity in multiple regressions may or may not be a serious problem in forecasting market premiums.

Equations (Q1) to (Q4) in Table VII examine the joint forecasting ability of the variables when we combine either DP or UPR with one of UTS or TB (see also Fama and French (1990)). In all cases, the variable that is related to the recent growth of the economy and the variable responsible for forecasting future GNP growth reinforce each other's explanatory power. Most of the adjusted R^2 are substantially above those for a single independent variable (Table III, Panel B). On the other hand, if we include both DP or UPR (or both UTS and TB) in the same regression (not reported here), they tend to weaken the explanatory power of each of them.

The variable YPL serves mostly as an indicator of the recent economic growth and partly as a predictor of the future economic growth. Regressions (Q5) to (Q8) examine how the other variables forecast market premiums in combination with YPL; regressions (Q5) and (Q6) indicate that YPL is more colinear with the two variables DP and UPR (indicators of the current health of the economy). Regressions (Q7) and (Q8) indicate that YPL is less collinear with the two variables UTS and TB (indicators of the future growth of the

[25]For example, DP, UPR, and YPL all have explanatory power for the recent GNP growth in multiple regressions. UTS, TB, and YPL all have explanatory power in predicting the future GNP growth in multiple regressions. In multiple regression forecasting market returns, if we include the fitted recent growth of GNP along with one of DP, UPR, or YPL, they tend to weaken the explanatory power of each other. The same is also true if we include the expected future growth of GNP along with either UTS or TB. These results are not reported here, but they are available from the author.

economy). Finally, (Q9) suggests that most of the forecasting power is captured by the combination of DP (an indicator of the current health) and TB (an indicator of the future growth) as explanatory variables.

Panel B of Table VII presents the quarterly regressions with annual observations. Consistent with recent findings, a higher fraction of the total variance of the yearly excess market return can be explained. The forecasting patterns by the state variables on the yearly excess market return are similar to those corresponding to the quarterly excess market return. One notable exception is regression (A9). Here, the explanatory power is spread between DP, TB, and YPL, indicating that the lagged productions variable contains some relevant information for determining the market risk premium that is not reflected in the combination of DP and TB.

Table VII

Multiple Quarterly Regressions of Excess Value-Weighted Market Return on Predictive Variables (1954–1986)[a]

DP is the ratio of dividends on the value-weighted NYSE portfolio for the previous 12 months to the value of the portfolio at the end of the quarter. UPR is the end of the quarter yield difference between Ibbotson's composite corporate bond yield and Aaa (Moody's) yield (annualized). UTS is the (annualized) average end of the quarter yield on 10-year government bonds (Citibase) and TB, the end of the quarter one-month Treasury Bill rate (annualized). YPL is the industrial production (seasonally unadjusted) growth over previous 12 months observed at the end of the quarter.

	DP	UPR	UTS	TB	YPL	$\bar{R}^2$
		Panel A. Quarterly Regressions With Quarterly Observations				
(Q1)	2.051		1.818			0.116
	(2.79)		(2.90)			
(Q2)	4.169			−1.059		0.159
	(5.85)			(−5.14)		
(Q3)		7.237		−0.634		0.082
		(3.15)		(−3.00)		
(Q4)		4.976	1.765			0.101
		(2.12)	(2.71)			
(Q5)	1.364				−0.247	0.066
	(1.77)				(−1.99)	
(Q6)		2.783			−0.260	0.056
		(0.91)			(−1.76)	
(Q7)			1.683		−0.282	0.117
			(2.58)		(−2.38)	
(Q8)				−0.509	−0.336	0.088
				(−2.48)	(−2.96)	
(Q9)	2.976	1.579	0.978	−0.797	−0.121	0.172
	(3.76)	(0.61)	(1.49)	(−3.58)	(−0.88)	

Table VII—*Continued*

Panel B. Quarterly Regressions With Annual Observations						
	DP	UPR	UTS	TB	YPL	$\bar{R}^2$
(A1)	8.482 (3.97)		4.974 (2.95)			0.302
(A2)	15.315 (6.96)			−3.378 (−5.08)		0.434
(A3)		26.83 (3.31)		−1.811 (−2.24)		0.200
(A4)		21.21 (2.67)	5.087 (2.78)			0.239
(A5)	6.07 (2.54)				−0.899 (−4.27)	0.258
(A6)		10.52 (1.06)			−1.012 (−3.82)	0.207
(A7)			4.602 (2.49)		−1.112 (−5.24)	0.291
(A8)				−1.359 (−1.89)	−1.293 (−5.39)	0.237
(A9)	11.432 (5.44)	3.08 (0.53)	2.408 (1.50)	−2.678 (−4.05)	−.531 (−3.01)	0.476

[a]The slope estimates for the regressions with annual observations are the average OLS estimates from the four quarterly split sample regressions (i.e., regressions using annual observations beginning at the ith quarter, i = 1, 2, 3, 4). The residuals are obtained by using these average OLS estimates on the full sample. Standard errors are then computed using these residuals, adjusted by the Newey and West (1987) method (see Huizinga (1984)). *t*-statistics are in parentheses.

Finally, if we exclude from (A9) those variables whose slope coefficients are less than 2 standard errors from 0 and add the unexpected future GNP growth (see Table VI) as an additional independent variable, we obtain (*t*-statistics in parentheses):

$$\begin{aligned}(\textit{Excess Market Return})_t = &\underset{(-4.06)}{-0.261} + \underset{(6.93)}{12.84}\, DP_{t-1} - \underset{(-5.79)}{2.96}\, TB_{t-1} \\ &\underset{(-3.22)}{-0.610}\, YPL_{t-1} + \underset{(4.64)}{3.940}\, (\textit{unexpected GNP growth})_t + \nu_t, \qquad \bar{R}^2 = 0.61\end{aligned}$$

The adjusted R^2 is similar to those reported in Fama (1990, Table V) which includes successive future quarterly industrial production growth rates as independent variables.[26] Thus, roughly the same proportion of market return

[26]Some information may be lost when we use just one long-term future growth rate variable rather than decomposing it into a series of quarterly growth rates. See Fama (1990) for a discussion of the smoothing effect of the production information reflected in market returns.

variations is captured by the two approaches. This, of course, is consistent with our story that variations in the expected excess market return that are due to changes in the macroeconomy are reflected in the state variables.

VI. Summary

In an intertemporal market equilibrium, the state variables that are priced are those that can forecast changes in the investment and consumption opportunity set. In this study, we confirm that the default spread, the term spread, the one-month T-bill rate, the lagged industrial production growth rate, and the dividend-price ratio are important determinants of future stock market returns.

We interpret the ability of these variables to forecast future market returns in terms of their correlations with changes in the macroeconomic environment. In particular, we find that these state variables are related to the recent and future growth of GNP (and consumption). Furthermore, the expected excess market return is negatively related to the recent growth of GNP (proxying for the current health of the economy) and positively related to its future growth. State variables that are positively (negatively) related to the recent growth of the economy are negatively (positively) related to the expected excess market return, and state variables that are positively (negatively) related to the future growth rates of the economy are positively (negatively) related to the expected excess market return. The collective evidence presents a unifying story that relates the ability of the state variables to forecast the market premium to their ability to forecast recent and future growth of the economy.

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