Asset Returns and Economic Risk

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Do financial markets offer higher rewards in the form of average returns for holding risks related to recessions and financial distress in addition to the risks from overall market movements? The answer to this question is related to the way financial economists understand the investment world. Fifteen years ago, financial researchers and practitioners thought that the capital asset pricing model (CAPM) provided a reasonable explanation of why different assets, portfolios, funds, and strategies earn different returns. According to the CAPM, the extra return earned by any risky asset comes from bearing market risk only. There is now considerable evidence against the CAPM, suggesting that variables other than the rate of return on a market portfolio proxy command significant risk premia. The intertemporal CAPM (I-CAPM) theory (Merton 1973) suggests that the premium on any risky asset is related to the market risk premium as well as to the risk premia on these additional variables. In this context, economic risk premia represent the compensation for holding assets that are exposed to prespecified sources of economic risk. Merton does not explicitly identify these additional sources of risk but shows that variables affecting a representative investor's risk-return trade-off should also command significant risk premia. Hence, the proper selection of additional risk factors has become one of the most challenging tasks in modern finance.

Beginning with Chen, Roll, and Ross (1986), the view that macroeconomic risks systematically affecting asset returns should also be significantly priced has attracted widespread attention and generated a large body of empirical work. Chen, Roll, and Ross argue that in selecting factors one should consider forces that will explain changes in the rate used to discount future expected cash flows and influence these cash flows themselves. On the basis of their intuitive analysis and empirical investigation, they propose a five-factor model with a maturity premium, expected and unexpected inflation, industrial production growth, and a default premium. They reach the striking result that even if the market portfolio explains a significant portion of the time-series variability of stock returns, it has an insignificant influence on expected returns when compared to the economic risk variables. However, given the lack of theoretical foundations, Chen, Roll, and Ross provide us only with plausible stories about the sign of the economic risk premia.

To date, the evidence concerning the sign and significance of risk premia of both traded (financial) and nontraded (economic) risk variables is less than conclusive. Consider, for example, a market portfolio proxy. A positive premium on the market portfolio would reflect the value of insuring against nondiversifiable market risk. Chen, Roll, and Ross (1986) find that the exposure to the rate of return on the value-weighted New York Stock Exchange

(NYSE) index commands a negative and statistically insignificant risk premium. On the other hand, Burmeister and McElroy (1988) find that exposure to market risk commands a positive and insignificant premium whereas McElroy and Burmeister (1988) find that the sign of the market premium changes depending on whether a January dummy is included. Ferson and Harvey (1991) estimate a market risk premium that is generally positive and in one case significant. Balduzzi and Robotti (2001) estimate a positive and statically significant premium on the equally weighted NYSE/AMEX/Nasdaq market portfolio.

A new generation of empirical research has found that there are assets, portfolios, funds, and strategies whose average returns seem to be better explained by multifactor models with economic risks than by the market CAPM.

The evidence on the premia associated with macroeconomic risk variables is equally mixed. For example, a negative premium associated with unexpected inflation would probably indicate that stock and bond market assets are generally perceived to be hedges against the adverse influence on other assets that are, presumably, relatively more fixed in nominal terms. If many people prefer assets that are less exposed to inflationary pressures, they bid up the prices of those assets or, equivalently, are willing to hold the assets at a lower average return. Chen, Roll, and Ross (1986) estimate negative and often significant risk premia on unexpected inflation. McElroy and Burmeister (1988) obtain negative and statistically significant estimates of the unexpected-inflation premium whereas Burmeister and McElroy (1988) obtain positive and significant estimates. Ferson and Harvey (1991) obtain estimates that are negative and marginally significant. In addition, the magnitudes of the estimated risk premia change substantially from one study to the other.

To demonstrate the importance of economic risk factors for expected asset returns, this article reviews and interprets recent advances in the asset pricing literature. The analysis focuses particularly on the link between multiple sources of economic risk and popular asset pricing models and interprets the premia on traded and nontraded risk variables as investors' attempts to hedge against macroeconomic and financial uncertainty.

In addition, this study empirically investigates the validity of Merton's (1973) intuition, according to which variables that affect the risk-return trade-off (or investment opportunity set) of an investor should also receive nonzero risk premia and explain equilibrium-expected returns. The analysis measures the impact of prespecified economic and financial variables on the risk-return trade-off by looking at how they affect (or predict) the mean and the variance of asset returns.[1]

The objective of the empirical analysis is to analyze the following two related issues: (1) the sources of economic risk that investors should track and hedge against and (2) the sign of the risk premia commanded by economic and financial risks. Specifically, this study establishes a link between a variable's effect on the mean of asset returns and the sign of the risk premium it commands. This link, also discussed in Balduzzi and Robotti (2001), is new relative to existing studies and sheds light on previous results. This issue can be illustrated in a scenario in which an expected inflation variable negatively affects average returns and positively affects the variance of asset returns. In that case, the effect on the investment opportunity set (or risk-return trade-off) would be negative, meaning the investor would receive a lower average return for a higher level of risk. Lower expected returns for a bigger quantity of risk should translate into a negative risk premium, that is, a negative compensation for bearing inflation risk.

Finally, this study relaxes the assumption of constant risk premia and analyzes the business cycle behavior exhibited by risk premia associated with different sources of risk in a manner consistent with the idea that the expected compensation for bearing different sorts of risk is larger at some times and smaller at other times, depending on economic conditions. Hence, it could be misleading to omit specific risks from a model on the basis of small average premia.[2]

Asset Pricing Models

Since Merton (1973), financial economists have begun to realize that factors—*state variables* or *sources of priced risk*—beyond movements in the market portfolio should be considered as explanations of why some average returns are higher than others. Investors' marginal value of wealth is affected not only by how the stock market performs but also by how their earnings, bonuses, real estate property, and numerous other sources of income or

BOX 1

The Capital Asset Pricing Model (CAPM)

The CAPM uses a *time series* regression to measure the exposure of asset i to market risk M.

$$R_{it} - R_{f,\,t-1} = \alpha_i + \beta_{iM}(F_{Mt} - R_{f,\,t-1}) + \varepsilon_{it}$$

for $t = 1, 2, \ldots, T$ and $i = 1, 2, \ldots, N$.[1] The conditional risk premium on asset i is given by

$$E_{t-1}(R_{it}) - R_{f,\,t-1} = \beta_{iM}\lambda_{M,\,t-1}$$

for $i = 1, \ldots, N$, where $\lambda_{M,\,t-1}$ is the possibly time-varying price of beta risk or market risk premium, the amount by which expected returns must rise to compensate investors for higher risk.

1. R_i denotes the return on asset i, R_f is the return on a riskless asset f, α_i is an asset-specific intercept term, ε_i is a mean zero asset-specific error term uncorrelated with the market, F_M denotes the return on the market portfolio M, β_{iM} represents asset i's exposure to nondiversifiable risk M, $R_i - R_f$ is the excess return on asset i, and $F_M - R_f$ is the excess return on the market portfolio.

wealth change over time. Hence, investors would be more willing to hold stock and bond market assets if these represented a good hedge against the possibility of negative developments. In other words, investors would be willing to pay a higher price for those assets that best hedge against macroeconomic as well as financial risk.

Despite the fact that the I-CAPM was proposed by Merton at the beginning of the seventies, relatively little work has been done in the last thirty years to test the validity of Merton's intuition.[3] Since the I-CAPM does not identify the risk factors, many researchers have simply disregarded the theoretical foundations of Merton's model and proposed multifactor models based on dubious equilibrium arguments. The finance profession is still in search of a theoretical link between expected returns and specific sources of economic risk.[4] The CAPM is a one-period model and assumes that the average investor cares only about the performance of his investment portfolio and chooses assets based on their exposure to nondiversifiable market risk. Box 1 summarizes the salient features of the CAPM.

Testing unconditional (constant) and conditional (time-varying) implications of the CAPM has been an ongoing effort for several decades. From an unconditional point of view, the CAPM would hold if the intercept term (α) and the slope coefficient (β) were equal to zero and one, respectively. The risk premium on any asset would then coincide with the market risk premium. From a conditional point of view, it seems that the time-varying price of market risk (λ) explains expected excess returns better than time-varying nondiversifiable risk as measured by the CAPM beta (β). This conditional view is one of the reasons this analysis estimates time-varying risk premia and disregards time variation associated with the nondiversifiable risk, β. For U.S. stock-market data for the past thirty years, the constant and conditional implications of the CAPM have been repeatedly rejected, casting many doubts on whether the CAPM is a realistic model of asset prices. On one side, some researchers argue that the evidence against the CAPM is overstated because of mismeasurement of the market portfolio proxy, improper neglect of conditioning information, data snooping, or sample-selection bias. On the other side, some financial economists argue that no risk-based model can explain the anomalies of stock market behavior.

Finally, some authors argue that multifactor models such as the I-CAPM perform better than the CAPM in explaining expected excess returns. (See Box 2 for a description of the I-CAPM.) In the I-CAPM, the market portolio serves as one factor and the state variables, F_A, F_B, . . . , serve as additional factors. The additional factors arise from investors' demand

1. This article considers asset returns as potentially predictable, in sharp contrast with what financial economists thought until the mid-1980s, when stock and bond returns were considered to be essentially unpredictable. According to this earlier view, any apparent predictability pattern would quickly vanish out of sample or would be unexploitable after accounting for transaction costs. Recent empirical findings show that asset returns have a substantial predictable component, at least over long horizons.
2. The conditional analysis is also motivated by the empirical finding that expected asset returns seem to be better explained by time-varying risk premia than by time-varying nondiversifiable risk.
3. See, for example, Campbell (1996), Cochrane (1996), Jagannathan and Wang (1996). Balduzzi and Robotti (2001) propose a novel test of the I-CAPM using mimicking portfolios.
4. Fully developed general equilibrium models with endogenously determined factor prices have not yet been proposed.

B O X 2

The Intertemporal Capital Asset Pricing Model (I-CAPM)

The I-CAPM uses a *time series multiple* regression to measure the exposure of asset i to the set of risk factors F_M, F_A, F_B, and so on.

$$R_{it} - R_{f,\,t-1} = \alpha_i + \beta_{iM}(F_{Mt} - R_{f,\,t-1}) + \beta_{iA}F_{At} + \beta_{iB}F_{Bt} + \ldots + \varepsilon_{it}$$

for $t = 1, 2, \ldots, T$ and $i = 1, 2, \ldots, N$, where F_M, F_A, F_B, etc., represent multiple risk factors and the βs represent the factor loadings. The risk premium on asset i is given by

$$E_{t-1}(R_{it}) - \mathrm{R}_{f,\,t-1} = \beta_{iM}\lambda_{M,t-1} + \beta_{iA}\lambda_{A,t-1} + \beta_{iB}\lambda_{B,t-1} + \ldots$$

for $i = 1, \ldots, N$, where $\lambda_{M,t-1}$, $\lambda_{A,t-1}$, $\lambda_{B,t-1}$, . . . represent the conditional market risk premium and the conditional premiums on the additional sources of economic risk, respectively.

to hedge uncertainty about future investment opportunities. Factors do not need to be traded portfolios of assets. Proposed factors include macroeconomic variables such as innovations in gross domestic product (GDP), changes in bond yields, unanticipated inflation, and so forth. While the CAPM has been widely tested and repeatedly rejected in its conditional and unconditional specifications, the I-CAPM has attracted less attention in the literature mainly because the proper identification of the fundamental risk factors is still an unresolved issue, leading Fama (1991) to characterize the I-CAPM as a "fishing license."[5]

The next section presents a survey of the risk factors that have been proposed so far and derives implications for premia on pervasive, or nondiversifiable, sources of investment risk.

Factor Risk Premia

There are both academic and practical reasons to measure risk premia associated with nontraded risks. First, these premia are an indication of how important an economic variable is for stock returns. Second, if new securities are introduced whose payoffs track an economic variable—for example, a business-cycle indicator—it is important to know how the new securities should be priced. Given the payoff function, the price of such a security depends on the risk premium assigned to the economic risk variable. Box 3 shows how to identify average and conditional risk premia associated with financial and economic factors.

The discussion now turns to the financial/economic factors proposed in the literature and the premia they command. Estimated coefficients of the risk premia differ from study to study in both size and sign.

Unanticipated and anticipated inflation. Chen, Roll, and Ross (1986) estimate negative and often statistically significant risk premia on unexpected inflation. McElroy and Burmeister (1988) obtain negative and statistically significant estimates of the unexpected-inflation premium whereas Burmeister and McElroy (1988) find positive and statistically significant estimates. Ferson and Harvey (1991) obtain negative and only marginally statistically significant estimates. Balduzzi and Robotti (2001) find a negative and statistically significant premium associated with anticipated inflation.

Consumption growth rate. The rate of growth in consumption of nondurables and services represents the only pricing factor behind the consumption-based capital asset pricing model (C-CAPM). According to the C-CAPM, investors are willing to pay to hedge against a future decline in consumption. Even though the C-CAPM has solid theoretical foundations, it is unable to empirically identify asset return comovements. Specifically, the rate of growth of consumption is positively but insignificantly priced, as shown, for example, in Ferson and Harvey (1991) and in Balduzzi and Robotti (2001).

Consumption-aggregate wealth ratio. The ratio of consumption to wealth proposed by Lettau and Ludvigson (2001) turns out to be a powerful predictor of asset returns even at short horizons. This article shows that the consumption-aggregate wealth ratio commands a positive and statistically significant risk premium. A positive risk premium mainly reflects investors' attempt to insure against future consumption risk. In a similar fashion, Santos and Veronesi (2001) find that the ratio of labor income to consumption is significantly priced and is positively associated with stock returns. Moreover, as this ratio fluctuates, the risk premium that investors require to hold risky assets fluctuates as well.

Industrial production growth rate. The risk premium associated with the growth rate in industrial production is generally positive and statistically significant, reflecting the value of insuring against real nondiversifiable production risks (see, for example, Chen, Roll, and Ross 1986).

BOX 3

Economic Risk Premia

The conditional factor risk premia are calculated as follows:

$$\lambda_{j,\,t-1} = -E_{t-1}[(q_t^* - 1)F_{jt}] = \gamma_{j1} + \gamma_{jM}F_{M,\,t-1} + \gamma_{jA}F_{A,\,t-1} + \gamma_{jB}F_{B,\,t-1} + \ldots$$

for $j = M, A, B, \ldots$, and $q_t^* = 1 - [\boldsymbol{R}_t - E_{t-1}(\boldsymbol{R}_t)]^T \Sigma_{RR,\,t-1}^{-1}[E_{t-1}(\boldsymbol{R}_t) - R_{f,t-1}\mathbf{1}]$.[1] This formula simply states that the conditional factor risk premiums are given by the negative of the conditional covariance between the pricing function, q_t^*, and the factor itself.

Without loss of generality, it is assumed that $\mathrm{Var}(F_{j,\,t-1}) = 1$ and $E(F_{j,\,t-1}) = 0$. Hence, the coefficients γ_{jM}, γ_{jA}, . . . , can be interpreted as the change in the conditional risk premium for a one-standard-deviation change in the lagged values of the factors. In addition, $E(\lambda_{j,t-1}) = \gamma_{j1}$ represents the average or unconditional premium associated with the variable j.

1. $\boldsymbol{R}$ and $\mathbf{1}$ represent $(N \times 1)$ vectors of asset returns and ones, respectively. Σ represents the $(N \times N)$ variance-covariance matrix of asset returns. See Balduzzi and Robotti (2001) for a rigorous explanation of the issues and techniques behind the risk premium calculations.

Innovations in GDP growth rate. Vassalou (forthcoming) argues that a factor that captures news related to future GDP growth along with the market factor can explain expected returns nearly as well as the Fama-French (1993) three-factor model.

Investment growth. Cochrane (1991, 1996) formulates and tests a partial equilibrium model in which the factors are returns on physical investment, inferred from investment data via a production function. He shows that a model that considers investment growth rates instead of investment returns produces similar results. The models do not seem to be rejected by the data, and the investment return factors are priced.

Market portfolio. Equally weighted and value-weighted portfolios on major stock market indexes have been repeatedly proposed as market portfolio proxies. The discussion in the previous section showed that the importance of the market portfolio is mainly due to its role as the only pricing factor in a CAPM world. The evidence on the sign and significance of the risk premia on the market portfolio is not conclusive, as evidenced by the studies cited in the introduction to this article (see page 13).

Real Treasury bill rate. Ferson and Harvey (1991) find that the real Treasury bill rate commands a positive and statistically significant risk premium consistent with the idea that investors perceive an increase in the real short-term rate as a higher real return on any form of capital, including risky assets holdings.

Default premium. The default premium is usually calculated as the return spread between corporate bonds rated Baa by Moody's Investor Services and a long-term U.S. government bond. Chen, Roll, and Ross (1986) and Ferson and Harvey (1991) estimate a significantly positive default premium. A positive default risk premium is consistent with investors' desire to hedge against unanticipated increases in the aggregate risk premium occasioned by an increase in uncertainty. The same positive sign is usually associated with the corporate yield spread between Baa and Aaa rated bonds. Keim and Stambaugh (1986) find that a yield spread has some predictive power for future bond and stock returns.

Term structure of interest rates. The term structure of interest rates, as measured by the return spread between a long-term government bond and a one-month bill, commands a negative and insignificant risk premium (Chen, Roll, and Ross 1986). Changes in the term structure command a positive and nearly statistically significant risk premium (Ferson and Harvey 1991). This article considers a short-maturity term structure as measured by the one-month return of a three-month Treasury bill less the one-month return of a one-month bill. The slope of this term structure is positively and significantly priced consistent with the idea that investors demand a higher premium to hold risky assets when the term structure becomes steeper.

Dividend yield. The dividend yield on major stock market indexes usually commands positive

5. Chen, Roll, and Ross state: "A rather embarrassing gap exists between the theoretically exclusive importance of systematic 'state variables' and our complete ignorance of their identity. The comovements of asset prices suggest the presence of underlying exogenous influences, but we have not yet determined which economic variables, if any, are responsible" (1986, 384).

but statistically insignificant risk premia (see, for example, Balduzzi and Robotti 2001).

Price/dividend, price/earnings, and earnings/dividend ratios. Fama and French (1988) argue that, at long horizons, a relevant portion of the variation in stock returns is forecastable ahead of time from the price/dividend ratio. Ratios formed with just about any sensible divisor work nearly as well, including earnings, book value, and moving averages of past prices. These economic factors also seem to be significantly priced. The earnings/dividend ratio proposed by Lamont (1998) also seems to receive a nonzero price of risk and to predict asset returns relatively well. These measures seem to explain not only aggregate market movements but also asset returns of individual firms.

The empirical results on time-varying risk premia suggest that, during periods of economic recessions, there are non-negligible gains from holding assets whose returns are positively related to market, term structure, default, and real Treasury bill risks.

Size and book-to-market factors. Small-cap stocks and value (or high-book/market) stocks have quite high average returns while large-cap and growth (or low-book/market) stocks seem to have low average returns. Fama and French (1993) show that the CAPM does a poor job explaining the abnormally high and abnormally low returns on such stocks. They propose a multifactor model with the market portfolio and two additional factors: the return of small less big stocks (SMB) and the return of high-book/market less low-book/market stocks (HML). Size and value factors seem to predict the rate of growth of GDP (see Liew and Vassalou 2000) and to be significantly priced, reflecting the value of insuring against nondiversifiable production risk.

Most of the variables listed here exhibit strong correlations with each other and are correlated with or help to forecast business cycles. Hence, the premia associated with these economic risks should be higher at the bottom of a business cycle, when investors require a higher excess return to hold risky assets.

Predictability of Asset Returns

This section describes the statistical and economic significance of time variation in the first and second conditional moments of asset returns. As noted in the introduction, this analysis of predictability helps explain why and how prespecified sources of economic and financial risk should be priced. Specifically, the analysis examines the factors' impact on the investment opportunity set and then relates it to the sign of the factor risk premia.

Box 4 describes the tools needed to understand predictability patterns in asset returns. This study considers two statistics: (1) the average impact of the lagged value of factor j ($j = M, A, B, \ldots$) on the mean of asset returns, $\bar{\mu}_j$, which represents the average slope coefficient in the mean equations, and (2) the average impact of the lagged value of factor j on the volatility of asset returns, $\bar{v}_j$, which represents the average slope coefficient in the volatility equations. These statistics provide an indication of the differential effect of the lagged values of the factors on the investment opportunity set.

The following section empirically identifies the impact of the economic/financial factors on the risk-return trade-off and relates it to the sign of the factor risk premia.

Data

In the empirical analysis, the monthly period considered is January 1960–December 1996 for stock and bond returns and December 1959–November 1996 for economic and information variables.

Asset returns. Using portfolio returns on stocks listed in the NYSE, AMEX, and Nasdaq, ten stock portfolios are formed according to size deciles on the basis of the market value of equity outstanding at the end of the previous year. If a capitalization is not available for the previous year, the firm is ranked based on the capitalization on the date with the earliest available price in the current year. The returns are value-weighted averages of the firms' returns with dividends reinvested. The securities with the smallest capitalizations are placed in portfolio one. The partitions on the Center for Research in Securities Prices (CRSP) file include all securities, excluding American Depository Receipts (ADRs), that are active on NYSE-AMEX-Nasdaq for each year.

Bond portfolio returns are grouped together with stock returns. The bond portfolios are a long-term government bond, a long-term corporate bond, and the Treasury bill that is closest to six months to maturity. The long-term government and corporate bonds are provided by Ibbotson Associates while the six-month Treasury bill rate is from CRSP (Fama Treasury Bill Term Structure Files). The one-month Treasury bill rate is from Ibbotson Associates SBBI module and pertains to a bill with at least one month to maturity.

BOX 4

Predictability

The mean and volatility of asset returns at time t are modeled as linear functions of the factors at time $t-1$.

$$E_{t-1}(R_{i,t}) = \mu_i + \mu_{iM} F_{M,t-1} + \mu_{iA} F_{A,t-1} + \mu_{iB} F_{iB,\, t-1} + \ldots$$

$$E_{t-1}[|R_{i,t} - E_{t-1}(R_{i,t})|] = v_i + v_{iM} F_{M,t-1} + v_{iA} F_{A,t-1} + v_{iB} F_{B,t-1} + \ldots$$

for $i = 1, \ldots, N$, where μ_{ij} and v_{ij}, $j = M, A, B, \ldots$ represent the coefficients of the mean and volatility equations, respectively. $|\cdot|$ represents the absolute value operator. The average effects on the investment opportunity set are based on the mean estimated coefficients from the mean and volatility equations.

All rates of return are deflated using monthly inflation. The monthly rate of inflation is from SBBI Yearbook and is not seasonally adjusted.

Economic variables and instruments. The analysis concentrates on a set of seven variables that have been previously used in tests of multiple-beta models and/or in studies of stock-return predictability. The factor selection approach used is to specify macroeconomic and financial market variables that are thought to capture the nondiversifiable risks of the economy.[6] These variables are statistically significant in multivariate predictive regressions of means and volatilities, or they have special economic significance.

- *INF* is the monthly rate of inflation (Ibbotson Associates).
- *XEW* represents the equally weighted NYSE-AMEX-Nasdaq index return (CRSP) less the monthly inflation rate from Ibbotson Associates.
- *HB*3 is the one-month return of a three-month Treasury bill less the one-month return of a one-month bill (CRSP, Fama Treasury Bill Term Structure Files).
- *DIV* denotes the monthly dividend yield on the Standard and Poor's 500 stock index (CITIBASE).
- *REALTB* denotes the real one-month Treasury bill (SBBI).
- *PREM* represents the yield spread between Baa- and Aaa-rated bonds (Moody's Industrial from CITIBASE).
- *CAY* represents the log consumption-aggregate wealth ratio (Lettau and Ludvigson 2001).

The lagged values of the previous seven variables serve as a proxy for the information investors use to set prices in the market. This choice of instruments mainly follows Ferson and Harvey (1991). The reason for using the lagged values of the economic variables as instruments is that the variables that explain asset returns should also help to predict returns.

Study Results

The following patterns emerge from the analysis, as reported in Table 1:

- The inflation rate (*INF*) has negative and significant average impact on returns and a positive and insignificant average impact on return volatility. Indeed, the inflation rate has the strongest negative effect on average returns.
- Lagged stock returns (*XEW*) have a positive and significant average impact on returns and a negative and significant average impact on return volatility.
- The slope of the term structure (*HB*3) has an overall positive and significant impact on returns. The impact on volatility is negative and insignificant. Indeed, the slope of the term structure has the strongest positive effect on average returns.
- The dividend yield (*DIV*) affects returns positively and significantly. The overall effect on volatility is also positive but insignificant.
- The default premium (*PREM*) has a positive impact on returns and a negative impact on volatility. Both effects are statistically insignificant.
- The real rate of interest (*REALTB*) affects returns negatively and significantly while the effect on volatility is positive but insignificant. The effect on average returns is negative and large in magnitude although smaller than the inflation rate.
- The log consumption-aggregate wealth ratio (*CAY*) positively affects returns and negatively affects volatility.

In summary, *INF*, *XEW*, *HB*3, *DIV*, and *REALTB* significantly affect the first conditional moment of

6. See, for example, Chen, Roll, and Ross (1986), Burmeister and McElroy (1988), McElroy and Burmeister (1988), Ferson and Harvey (1991, 1999), Downs and Snow (1996), Kirby (1998), and Lettau and Ludvigson (2001).

TABLE 1

Average Slope Estimates of Mean and Variance Equations

Var	*INF*	*XEW*	*HB*3	*DIV*	*PREM*	*REALTB*	*CAY*
$\bar{\mu}_j$	**–1.9119**	**0.7324**	**1.0273**	**0.9527**	0.3192	**–1.2082**	0.2469
	(–4.34)	(3.47)	(3.09)	(2.84)	(1.20)	(–3.27)	(1.23)
$\bar{v}_j$	0.3701	**–0.30578**	–0.2366	0.3656	–0.0521	0.1384	–0.1502
	(1.40)	(–2.26)	(–0.94)	(1.72)	(–0.33)	(0.62)	(–1.26)

Note: The table reports estimates of a predictive model of the conditional mean and volatility of the returns on ten size-sorted equity portfolios and on three bond portfolios (see Box 4). *INF* denotes the monthly rate of inflation (percentage points per month). *XEW* is the equally weighted NYSE-AMEX-Nasdaq index return less the monthly inflation rate (percentage points per month). *HB*3 is the one-month return of a three-month Treasury bill less the one-month T-bill rate (percentage points per month). *DIV* is the monthly dividend yield on the Standard and Poor's 500 stock index (percentage points per month). *REALTB* is the real one-month Treasury bill rate (percentage points per month). *PREM* represents the yield spread between Baa- and Aaa-rated bonds (percentage points per month). *CAY* represents the monthly log consumption-aggregate wealth ratio (percentage points per month). T-statistics, in parentheses, are adjusted for heteroskedasticity and serial correlation. The coefficients that are significant at the 5 percent level are highlighted in bold. The sample period is 1959:12–1996:11.

asset returns. The consumption-aggregate wealth ratio and the default premium affect average returns positively but insignificantly. The value-weighted market index is the only variable that significantly affects returns' volatility. This preliminary analysis of predictability is useful for two reasons. First, economic and financial factors that affect the first and second conditional moments of asset returns should also be priced by the market. Second, these predictability patterns make it possible to establish a link between the effect of a variable on the risk-return trade-off and the sign of the risk premium it commands.

The previous results are based on an in-sample investigation of asset returns' properties. An out-of-sample analysis is beyond the goal of this article for several reasons. First, models that predict well in sample are not necessarily the correct models out-of-sample. Second, good in-sample predictors are not necessarily good out-of-sample predictors. Finally, results are sensitive to the length of the chosen out-of-sample testing windows, to the horizon and type of assets considered, and to the frequency of the data.[7]

Risk Premia

In this section, the average and conditional factor risk premia are estimated, and the sign of the average premia is related to the average impact of each factor on the investor's risk-return trade-off. The distinction between average and conditional risk premia is important because, even if the average premium is close to zero, the conditional premia may take values over time that are quite different from zero. Moreover, modeling premia as time-varying is consistent with the empirical evidence that asset returns fluctuate over the business cycle.

These estimations reveal the following patterns reported in Table 2:

- The average inflation premium is negative, as one would expect given the negative impact of inflation on the mean of asset returns. The premium equals –12 basis points. There is also evidence of statistically significant time variation. The inflation premium is more negative for higher market returns and dividend yield and less negative for higher consumption-aggregate wealth ratio.
- The average market risk premium is positive and significant, consistent with its positive effect on investment opportunities. The premium increases with the yield spread between Baa- and Aaa-rated bonds.
- The average risk premium on the slope of the term structure is positive and significant. This result is consistent with the evidence that a steeper yield curve has a positive effect on investment opportunities. The premium increases with the inflation rate.
- The average risk premium on the dividend yield is positive and insignificant, consistent with the results of the predictability analysis. As with other premia, there is significant time variation. The premium becomes less negative as the default premium and the real rate increase and more negative as stock returns increase.
- The default premium receives a significant positive average risk premium. This result is consistent with the mildly positive effect on investment opportunities. The premium increases with the dividend yield and with the yield spread between Baa- and Aaa-rated bonds.
- The real rate of interest commands a positive average risk premium, consistent with Ferson and

TABLE 2

Economic Risk Premia

Risk Premia	λ_{INF}	λ_{XEW}	λ_{HB3}	λ_{DIV}	λ_{PREM}	λ_{REALTB}	λ_{CAY}
Average Premia	**–0.1168**	**0.1217**	**0.1004**	0.0118	**0.0916**	**–0.1601**	**0.0341**
	(–6.02)	(4.83)	(5.27)	(0.63)	(4.50)	–(8.16)	(2.38)
F_{INF}	0.0347	–0.0732	**0.1599**	0.0261	–0.0776	–0.0417	**0.0598**
	(0.67)	(–1.31)	(2.73)	(0.58)	(–1.72)	(–0.89)	(2.01)
F_{XEW}	**–0.0720**	–0.0226	–0.0191	**–0.0536**	–0.0359	0.0238	–0.0105
	(–2.87)	(–0.66)	(–0.94)	(–2.17)	(–1.74)	(0.89)	(–0.53)
F_{HB3}	–0.0128	–0.0420	0.0525	0.0136	0.0363	0.0143	–0.0153
	(–0.41)	(–0.52)	(1.16)	(0.35)	(1.09)	(0.43)	(–1.16)
F_{DIV}	**–0.0922**	–0.0071	0.0150	–0.0393	**0.0724**	**0.1261**	–0.0219
	(–3.26)	(–0.14)	(0.46)	(–0.97)	(2.07)	(3.75)	(–1.04)
F_{PREM}	0.0090	**0.0776**	0.0336	**0.0855**	**0.1055**	0.0325	0.0320
	(0.24)	(2.14)	(0.89)	(2.70)	(2.50)	(0.89)	(1.77)
F_{REALTB}	0.0493	–0.0267	0.0762	**0.0943**	–0.0047	–0.0089	**0.0482**
	(1.15)	(–0.55)	(1.72)	(2.27)	(–0.11)	(–0.22)	(1.98)
F_{CAY}	**0.0369**	–0.0364	–0.0051	–0.011	–0.0001	–0.0316	–**0.0655**
	(2.09)	(–1.82)	(–0.35)	(–0.72)	(–0.01)	(–1.69)	(–3.03)

Note: The table reports coefficients of the economic risk premia on the economic variables (see Box 3). *INF* denotes the monthly rate of inflation (percentage points per month). *XEW* is the equally weighted NYSE-AMEX-Nasdaq index return less the monthly inflation rate (percentage points per month). *HB*3 is the one-month return of a three-month Treasury bill less the one-month T-bill rate (percentage points per month). *DIV* is the monthly dividend yield on the Standard and Poor's 500 stock index (percentage points per month). *REALTB* is the real one-month Treasury bill rate (percentage points per month). *PREM* represents the yield spread between Baa- and Aaa-rated bonds (percentage points per month). *CAY* is the monthly log consumption-aggregate wealth ratio (percentage points per month). T-statistics, in parentheses, are adjusted for heteroskedasticity and serial correlation. The coefficients that are significant at the 5 percent level are highlighted in bold. The sample period is 1959:12–1996:11.

Harvey (1991). This result may appear puzzling given the negative effect on average asset returns. Yet investors should care about both the slope and the position of the risk-return trade-off. A higher real rate of interest means higher average returns per unit of risk, which may more than compensate for the negative effect on the slope of the risk-return trade-off. As with other risk premia, there is significant time variation. The premium increases with the dividend yield.

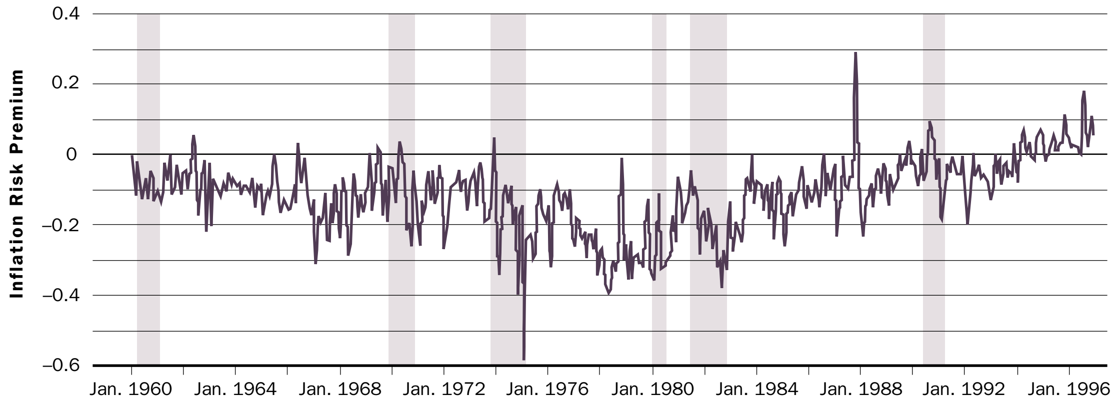
- The consumption-aggregate wealth ratio commands a positive average risk premium. This result is consistent with the positive impact of the consumption-aggregate wealth ratio on the mean of asset returns. As with other risk premia, there is significant time variation. The premium increases with inflation and the real rate and decreases with the consumption-aggregate wealth ratio.

A few conclusions can be drawn from the results above: First, the sign and significance of the average risk premia associated with the selected economic variables are largely consistent with the predictability patterns previously documented. Hence, there is support for Merton's (1973) I-CAPM intuition. Second, conditional risk premia exhibit significant time variation. Charts 1–7 show the time-varying patterns of the seven economic risk factors of this study.[8] The vertical bars denote reference business cycles determined by the National Bureau of Economic Research (NBER). Overall, economic risk premia strongly fluctuate over the business cycle. The inflation and the consumption-aggregate wealth premia exhibit procyclical patterns—that is, they decrease during periods of recessions and increase during economic booms. On the other hand, the market, term structure, default, and real Treasury bill

7. Daily, weekly, and monthly stock returns are close to unpredictable, and "technical" systems for predicting such movements are still nearly useless. Predictability patterns would become weaker when performing an out-of-sample analysis based on the same predictive model used in its in-sample counterpart. For example, results not reported in the text show that the predictive model that uses the seven factors described above fails to successfully predict directions in up and down markets.
8. The corresponding 95 percent exact confidence bounds, not reported in the graphs, are relatively large and indicate that the time-varying patterns of the economic risk premia should be taken with caution.

CHART 1

Time-Varying Inflation Risk Premium



Note to all charts: The set of instruments includes a constant and the lagged values of *INF*, *XEW*, *HB*3, *DIV*, *PREM*, *REALTB*, and *CAY*. The vertical lines denote reference business cycles determined by the National Bureau of Economic Research.

CHART 2

Time-Varying Market Risk Premium

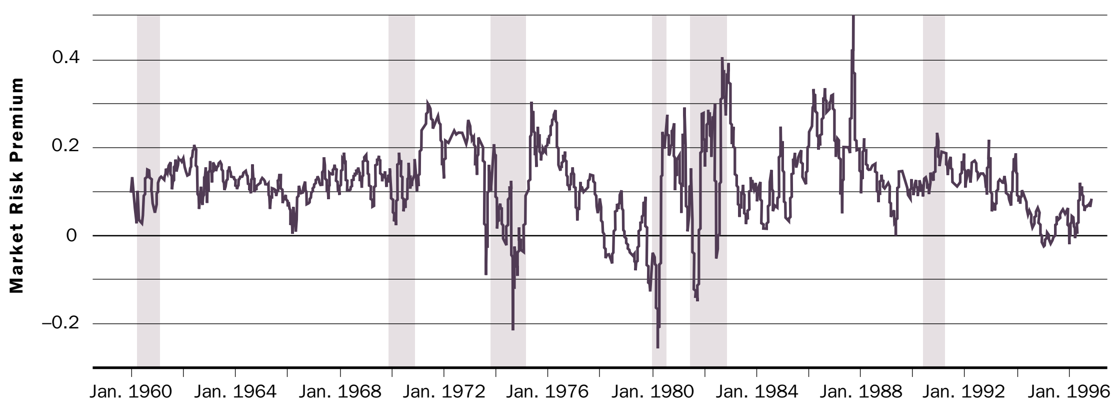


CHART 3

Time-Varying Term Structure Premium

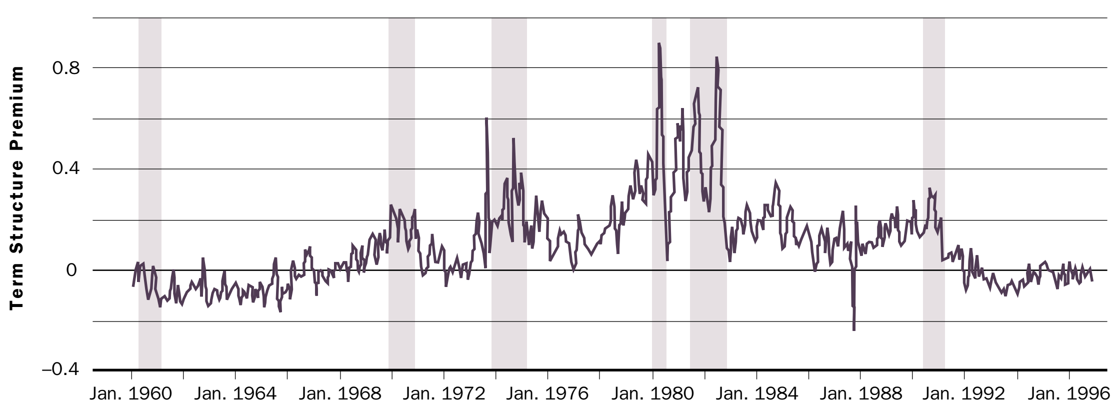


CHART 4

Time-Varying Dividend Yield Premium

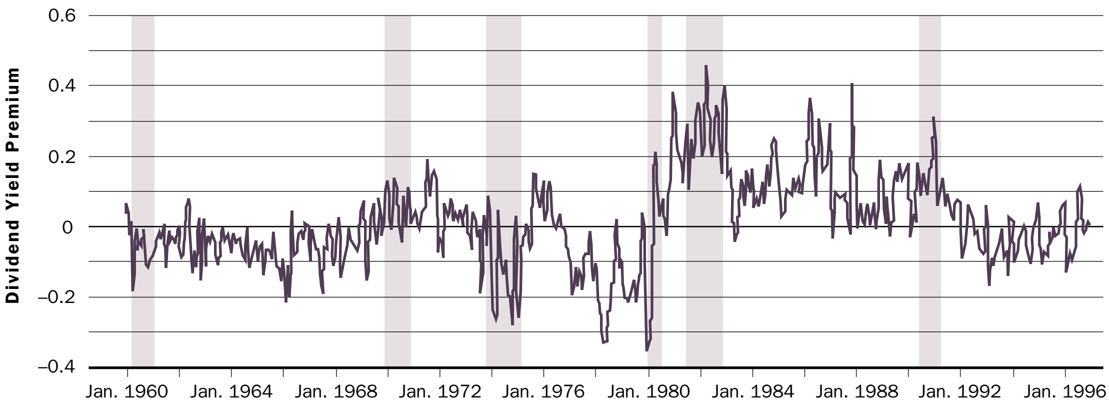


CHART 5

Time-Varying Default Premium

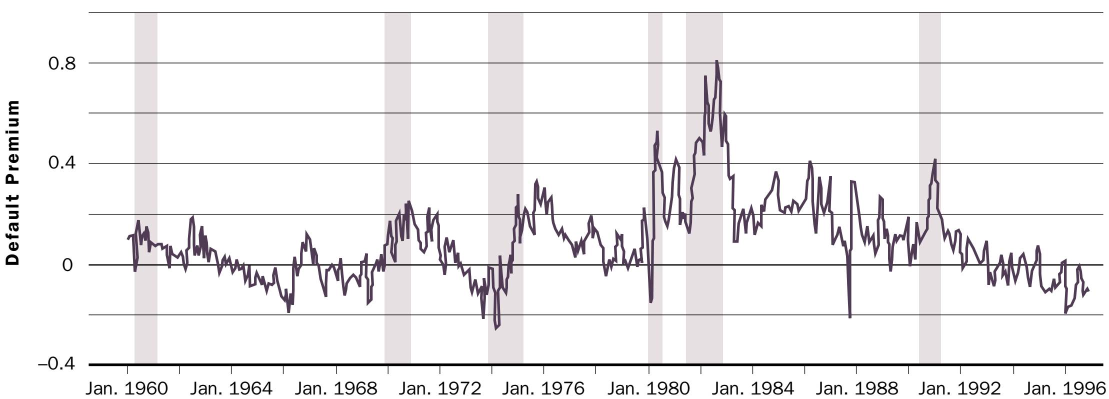


CHART 6

Time-Varying Treasury Bill Premium

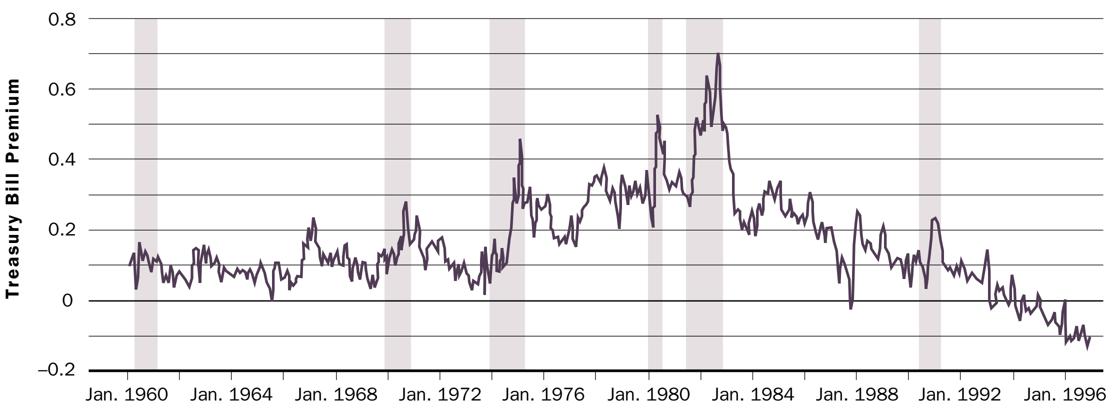
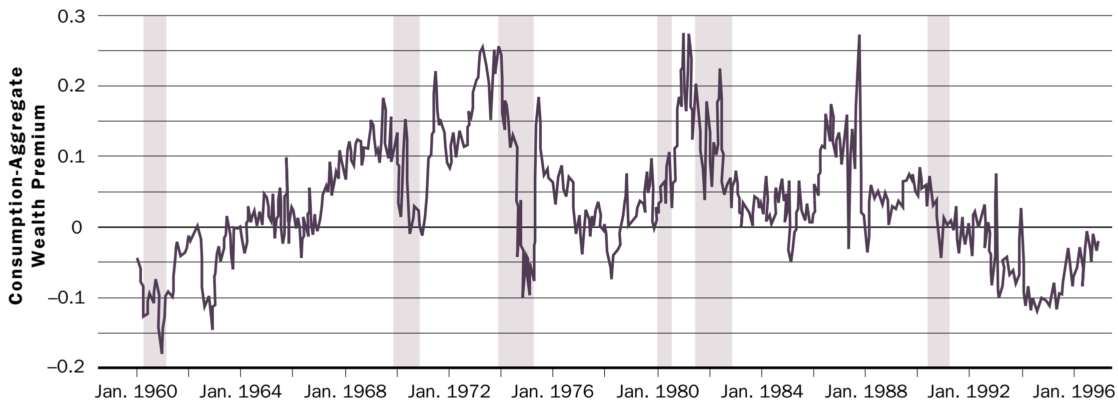


CHART 7

Time-Varying Consumption-Aggregate Wealth Premium



premia seem to be strongly countercyclical. Indeed, countercyclical variation in expected returns is consistent with intertemporal asset pricing models. With decreasing risk aversion, high expected returns are required in recessions to induce investors away from current consumption and into risky investments. Until the mid-1970s, the dividend yield premium was procyclical and countercyclical afterward.

Conclusion

A new generation of empirical research has found that there are assets, portfolios, funds, and strategies whose average returns seem to be better explained by multifactor models with economic risks than by the market CAPM. This article shows that variables affecting the risk-return trade-off are also significantly priced and establishes a link between an economic variable's effect on the risk-return trade-off and the sign of the average risk premium it commands. Specifically, variables such as the market portfolio, the term structure, the default premium, and the consumption-aggregate wealth ratio positively affect average asset returns and command positive risk premia. The inflation portfolio negatively affects average returns and commands a negative risk premium.

The article also provides extensive evidence of time variation in economic risk premia, consistent with the idea that expected compensation for bearing different sorts of risk is larger at some times and smaller at others, depending on economic conditions. Specifically, the analysis shows that the inflation and the consumption-aggregate wealth premia exhibit procyclical patterns. In contrast, the market, term-structure, default, and real Treasury bill premia seem to be strongly countercyclical. Finally, the dividend yield premium appears to be procyclical until the mid-1970s and countercyclical afterward.

In summary, this article sheds light on some of the risk factors that investors should track to hedge against financial and economic uncertainty, explains where the extra return for holding risky assets comes from, and reveals the direction of the compensation for bearing macroeconomic risk. Investors receive a positive compensation for holding assets whose returns are positively related to market risk, interest rate risk, and consumption risk. On the other hand, investors would earn a negative premium from holding stock and bond market assets whose returns are inversely related to increases in inflation. According to this interpretation, stock and bond market assets seem to provide a good hedge against inflation compared to assets that are more fixed in nominal terms.

The empirical results on time-varying risk premia also suggest that, during periods of economic recessions, there are non-negligible gains from holding assets whose returns are positively related to market, term structure, default, and real Treasury bill risks. On the other side, the compensation for holding assets whose returns are inversely related to increases in inflation becomes smaller during periods of recession, as does the compensation for holding assets whose returns are positively related to increases in the consumption-aggregate wealth risk.

Future work should try to investigate more formally the link between predictability and risk premia in the context of partial equilibrium and general equilibrium asset pricing models. An extensive analysis of time-varying risk premia would also be informative.

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