FORWARD-LOOKING MARKET RISK PREMIUMS (1992-2020) AND MACROECONOMIC FACTORS: INFLATION, REAL GDP, STOCK MARKET VOLATILITY AND TERM SPREAD

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INTRODUCTION

Shakespeare wrote, *"Whereof what's past is prologue; what to come, in yours and my discharge*."[2] Indeed, the past does not determine the future, not even for stock returns and the market risk premium. The Securities Exchange Commission requires mutual fund prospectuses to include the caveat that a fund's past performance does not necessarily predict future results.[3] Yet, largely due to the paucity of forward-looking equity return data, realized (historical) stock returns are frequently used to estimate the market risk premium[4], a key input of the widely used Capital Asset Pricing Model (CAPM) valuation tool. The CAPM is used to estimate the cost of equity component of a firm's cost of capital which is used in corporate finance, investment portfolio development, and regulatory rate proceedings.[5] The model's market risk premium component equals investors' expected return on the market less the risk-free rate and, thus, should be forward looking. Using a historical market risk premium is unlikely to reflect return expectations of investors, which can lead to inaccurate results with costly implications for investment decisions and public utility customers' rates. Nevertheless, historical market risk premiums are frequently used to estimate the market risk premium in CAPM analyses because calculating the average realized market risk premium based on historical stock returns is fairly

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[2] *The Tempest*, Act 2, Scene 1.

[3] https://www.investor.gov/introduction-investing/investing-basics/glossary/mutual-funds-past-performance.

[4] Koutmos (2015) reports many such papers use historical realized mean equity returns to proxy the *ex ante* investor expected equity risk premium.

[5] For example, the Federal Energy Regulatory Commission (FERC) uses the CAPM as one of three approved models for determining the authorized return on equity in electric transmission and wholesale sales rate proceedings. (*See* FERC Docket No. EL14-12-004, Order on Rehearing Opinion No. 569-A issued May 21, 2020 and Opinion 569-B issued November 19, 2020.)

easy given the relatively wide availability of stock return data. The opposite is true for determining the forward-looking market risk premium which reflects investors' unobservable expectational return on the market portfolio of aggregate wealth. One of this paper's main contributions is the use of an expectational market return to estimate the forward-looking (*ex ante*) market risk premium at the end of each quarter over a 29-year period through 2020. Investors' expected returns were estimated using the Discounted Cash Flow (DCF) model applied to all dividend-paying companies of the S&P 500 quarterly from 1992-2020 using consensus financial analyst growth forecasts, and from which the contemporaneous 20-year Treasury bond yield was subtracted to estimate the forward-looking market risk premium at each quarter-end. We compare these *ex ante* market risk premia to historical (*ex post*) market risk premia and find that, while larger, the forward-looking market risk premia are more stable with lower standard deviations than *ex post* market risk premia regardless of time horizon. We also examine the relationship of the *ex ante* market risk premium to various macroeconomic factors that other studies have examined often with *ex post* equity risk premia. This paper additionally examines forecasted inflation and forecasted GDP growth relative to the *ex ante* market risk premium as prior studies have focused more on actual inflation and actual GDP growth. We find that during the 1992 to 2020 period, the *ex ante* market risk premium has (1) a statistically significant strong negative correlation to long-term government bond yields, (2) a statistically significant strong negative correlation to expected inflation (both for 5-year and 30-year forecast horizons), (3) a statistically significant positive correlation to stock market volatility, and (4) no strong correlation with actual inflation, actual GDP, forecasted GDP, or the term spread.

1. Review of Literature

1.1. ***Market Risk Premium Estimation***

The CAPM (Sharpe, 1964), which earned William F. Sharpe the 1990 Nobel Prize, is widely used by financial analysts to estimate the cost of equity.[6] It is also one of two market-based models often used in public utility rate case testimony and by public utility regulatory commissions to determine the cost of equity component of the authorized overall cost of capital for public utilities in rate case proceedings (the DCF model is the second most widely used).[7] The CAPM posits that the required return, *R*, for a security *j*, is equal to the risk-free rate, *Rf*, plus the product of security *j's* measure of systematic risk (beta), β, and the expected return on a market portfolio, *Rm*, less *Rf*. The expected return on the market portfolio, *Rm*, is a theoretical diversified portfolio consisting of all assets weighed in proportion to its total presence in the market. The CAPM is mathematically specified as follows:

$$R_j = Rf + \beta_j \times (Rm - Rf).$$

The term *Rm – Rf* measures the expected return on the market above the risk-free rate of return and is the market risk premium. The return on a broad equity index, like the S&P 500, is commonly used to proxy the return on the market portfolio and, consequently, the term *Rm – Rf* is also referred to as the equity risk premium (the terms "market risk premium" and "equity risk premium" are, thus, used interchangeably in this paper).

Several approaches have been used to estimate the market risk premium. (1) ***Equity Returns*** – This approach measures the market risk premium by subtracting the risk-free rate from a broad equity index's return. Two methods have been employed: (i) using historical, realized stock returns (*ex post* approach), or (ii) using forward-looking investor-required stock returns (*ex ante* approach). Two well-known and annually updated sources for the *ex post* approach are by Duff

[6] Michelfelder (2015) reports that a survey of financial professionals indicates 91% of publicly traded firms use the CAPM to estimate the cost of capital.

[7] S&P Global Market Intelligence, *RRA Regulatory Focus - The Rate Case Process: Establishing a Fair Return for Regulated Utilities*, June 9, 2020.

and Phelps[8] that use S&P 500 realized returns minus the income return of a 20-year Treasury bond compounded annually, and Damodaran (2021) who uses S&P 500 realized returns minus the total return of a 10-year Treasury note. The average historical equity risk premium Damodaran (2021) reports is 6.43% from 1928 to 2020. The forward-looking *ex ante* approach measures equity returns predominantly using the DCF model, a valuation method based on the present value of a stock's future cash flows (Malkiel, 1979; Brigham, Shome and Vinson, 1985; Harris and Marston 1992, 2001 and 2013; and Fama and French (2002)). The DCF model and the equity risk premium results using this method is described later in greater detail. (2) ***Surveys*** – This approach averages the responses of institutional investors, investment professionals, and/or Chief Financial Officers (CFOs) on their expected equity returns (Graham and Harvey, 2018; other non-published survey sources are reported in Brigham et al, 1985, and in Damodaran, 2021). Graham and Harvey report a 4.42% equity risk premium in 2018 based on a quarterly survey of CFOs from 2000 to 2017. (3) *Implied or Observed Relationship to Other Factors* – This approach estimates the equity risk premium using factors other than equity returns. For example, Santa Clara and Yan (2010) use S&P 500 options from 1996 to 2002 to estimate an implied risk premium of 6.8%. Duan and Zhang (2014) estimate a forward-looking market risk premium based on investor risk aversion, forward-looking volatility, skewness and kurtosis of cumulative returns. They estimate an average monthly market risk premium of 0.13% to 5.71% in the period 2001- 2010. Damodaran (2021) observes the relationship of the default spread on Baa bonds over the 10-year Treasury bond yield from 1960 to 2020 and estimate the imputed equity risk premium, based on the 2.18% default spread on January 1, 2021, was 4.40%.

[8] The *Duff and Phelps Valuation Handbook* that annually updates and publishes this information was formerly published as the Morningstar/Ibbotson *Stocks, Bonds, Bills and Inflation (SBBI) Valuation Yearbook*.

Critiques of the *ex post* approach have long been noted. Brigham, Shome and Vinson (1985) observed the selected period, particularly the beginning and end points, are arbitrary and significantly affect the resulting equity risk premium. Elton (1999) concluded from his study that realized returns are a very poor measure of expected returns. Examining equity risk premia in nine industrialized countries from 1870-2002, Madsen and Dzhumashev (2009) aver *ex post* equity risk premia are biased upwards as they are significantly positively related to realized inflation from 1915 to 1960. Koutmos (2015) posit that observed risk-return inconsistencies in studies are largely due to the use of historical *ex post* data to explain equity risk premium variations as *ex post* returns are unable to properly estimate investors' expected *ex ante* required rate of return. Specifically, he notes *ex post* mean returns don't reflect investors' future risk estimates which are based on current volatility and news regarding future volatility.

The survey approach's drawbacks include biased responses and biased sampling (Brigham, Shome, Vinson, 1985) and the result is affected by how the question is asked and recent stock price movements (i.e., increasing after market run-ups, decreasing after market declines) (Damodaran, 2021). Kaustia, Lehtoranta and Puttonen (2013) find that more sophisticated financial advisers (as determined from their financial adviser exam scores) tend to have lower return expectations. Graham and Harvey (2018) also note their survey of CFOs only had a 5% to 8% response rate.

Lastly, in addition to their complexity, examining observed relationships of various factors over time to estimate the implied market risk premium using a variety of statistical techniques, rests on an assumption that the observed relationship (some based on historical data) is stable over time. In contrast, using the DCF model is a more direct method to estimating investors' equity return expectations and avoids many pitfalls of the other approaches as it relies only on forward-looking inputs.[9]

The advantages of using financial analyst earnings growth forecasts in cost of capital estimation and equity valuation is supported by the literature (Brown and Rozeff, 1978; Malkiel and Cragg, 1982; Chatfield, Moyer and Sisneros, 1989; and Ramnath, Rock and Shane, 2005) and has been used in forward-looking market risk premium studies that utilize the DCF model. One of the earliest studies using financial analyst earnings growth rate forecasts and a non-constant growth DCF model was Malkiel (1979) which estimated the equity risk premium to range from a little above 3% to almost 7% for the period 1960 to 1977 and Brigham, Shome, Vinson (1985) which estimated the equity risk premium for the Dow Jones Industrials to range from 3.75% to 6.88% for the period 1966 to 1984 and for the Dow Jones Electrics to range from 3.61% to 8.72% for the same period. Using a constant growth DCF model with consensus financial analyst earnings growth rate forecasts, Harris and Marston (1992, 2001, 2013) estimated the equity risk premium for the S&P 500 averaged 6.47% for the period 1982-1991, ranged from 5.18% to 9.17% (7.14% mean) for the period 1982-1998, and ranged from 5.57% to 10.46% (8.27% mean) for the period 1986-2010.

Our study uses quarterly, forward-looking market returns calculated by the Illinois Commerce Commission's Financial Analysis Division (ICC) over nearly three decades to determine a CAPM-based cost of equity estimate for utility rate setting purposes. While the ICC's method of calculating forward-looking market returns pre-dates Harris and Marston (1992, 2001, 2013), the ICC method is relatively close to Harris and Marston's constant growth DCF model approach to estimating the market return and use of consensus financial analyst growth

[9] A properly applied DCF model uses current inputs for a security's price, expected dividends, and forecasted growth rate.

rate forecasts. Our study differs from Harris and Marston in many respects including use of 20-year U.S. Treasury bond yields as the risk-free rate proxy instead of 30-year Treasury bond yields; use of an annual, semi-annual, or quarterly DCF model to match the applicable dividend payment schedule of each S&P 500 company; and use of different financial analyst growth forecast sources (I/B/E/S is used in the earlier years but also growth rates from Zacks and Reuters). Additionally, our study conducts ordinary least squares regression analyses on the *ex ante* market risk premia against various economic variables that span 29 years and through 2020. This paper also compares the forward-looking *ex ante* market risk premium estimates for various time periods to the historical *ex post* market risk premium estimates reported by Damodaran (2021).

1.2 ***Market Risk Premium Over Time and Relationship to Macroeconomic Factors***

Accurate prediction of the equity risk premium has important implications for asset allocations and investment decisions such that various studies have examined the variability of the equity risk premia over time and its relationship to a host of macroeconomic factors. Caporale, Gil-Alana, and Martin-Valmayor (2021) show that the market risk premium is a highly persistent variable that follows a “random walk.” Earlier studies observed the expectational *ex ante* equity risk premium changes over time (Brigham, Shome, Vinson (1985); Harris and Marston, 1992, 2001, and 2013; Fama and French, 2002). Fluctuations are also observed in the historical *ex post* equity risk premium over time (Damodaran 2021). Some studies have noted the equity risk premium in general has been declining (Siegel, 1999; McGrattan, Jagannathan, Scherbina, 2000) or increasing over time (Siegel, 2004) and, when using expected real per capita GDP growth in estimating the market return, was zero or negative in the early 2000s (Arnett and Bernstein, 2002). Historical *ex post* equity risk premium data show that they have been negative over several years especially during recessionary periods and stock market declines.[10] Lee, Kim and Kim (2014) find that the equity premium over short-term horizons are smaller compared to those over a medium or long-term investment horizon.

Literature on equity risk premium prediction that focus on macroeconomic factors often rely on *ex post* equity risk premia. While our study does not seek to predict the equity risk premium *per se*, it contributes by examining *ex ante* equity risk premium correlations with certain macroeconomic factors over a more recent period. Faugere and Erlach (2006) find that GDP growth is strongly related to the observed long run equity risk premium of 8.1%. Lettau, Ludvigson and Wachter (2008) observed that when macroeconomic risk falls, expected stock returns and the equity risk premium also fall. They posit that a macroeconomic risk decline in the 1990s explain their model's higher predicted valuation ratios due to a decline in the equity risk premium. Buncic and Tischhauser's (2017) find that 14 macroeconomic factors (which include the long-term U.S. Treasury bond yield, the term spread between long-term U.S. Treasury bond yield and U.S. Treasury bill rate, default yield spread between Moody's Baa- and Aaa-rated corporate bond yields, and actual inflation) improve their method of out-of-sample equity premium forecasts, but that such predictability declines beginning in 1992. More to the point, Berkman, Jacobsen and Lee (2015) find a positive correlation between the *ex ante* equity risk premium to (1) heightened global political uncertainty, (2) fluctuations in uncertainty on expected GDP growth and expected consumption growth, (3) the term spread between the six-month and three-month U.S. Treasury bill rate; and (4) the default spread between Moody's Baa- and Aaa-rated corporate bond yields. Older literature reports a strong negative (inverse)

[10] See S&P 500 realized returns by year data (including dividends) from Dr. A. Damodaran's website at: http://www.stern.nyu.edu/~adamodar/New_Home_Page/data.html.

correlation between the *ex ante* equity risk premium and interest rates as measured by long-term U.S. Treasury bond yields (Brigham et al, 1985; Harris and Marston, 1992, 2001, 2013). Harris and Marston (2001 and 2013) also observe the *ex ante* equity risk premium based on the S&P 500 to be strongly positively correlated to the spread between corporate bonds and U.S. Treasury bond yields but their regression data showed a weak correlation with consumer confidence or an implied measure of volatility for the S&P 500. Kim, Morley and Nelson (2004), on the other hand, find that when accounting for volatility feedback effects, there is a significant positive relationship between stock market volatility and an equity premium calculated using realized returns. Using annual *ex post* equity risk premia in several industrialized countries from 1871 to 2002, Kyriacou, Madsen and Mase (2006) conclude that the higher observed equity risk premia post-1914 is due to inflation over the same period, accounting for approximately two percentage points of the observed equity risk premium.

We examine many of these macroeconomic factors and their relationship to the forward-looking *ex ante* equity risk premium measured quarterly from 1992 to 2020. Specifically, we look at (1) long-term interest rates using 20-year U.S. Treasury bond yields, (2) market volatility using the Market Volatility Index (VIX), (3) actual real GDP growth, (4) forecasted real GDP growth, (5) actual inflation as measured by the Consumer Price Index for all urban customers (CPI-U), (6) expected CPI-U for five and 30 years, and (7) the term spread between 20-year Treasury bond yields and the one-year U.S. Treasury bill yield.

2. METHODOLOGY AND DATA

2.1. ***Market Risk Premium Estimation***

The CAPM's market risk premium is determined by taking investors' forward-looking market return requirement, *Rm*, and subtracting the risk-free rate, *Rf*, for which practitioners have used a 10-, 20-, or 30-year U.S. Treasury bond yield to proxy. The ICC has calculated a forward-looking market return for the purpose of applying it to the CAPM used in public utility rate proceedings since 1986 and regularly as of the end of each calendar quarter beginning in 1992. The approach applies a constant growth DCF model on every dividend paying company in the S&P 500 as of the end of each calendar quarter. Non-dividend paying companies or companies without a growth rate were excluded since a DCF model cannot be properly applied to such companies. The dividend paying companies' average weight in the S&P 500 over the period of study is a robust 84.4%.

The basic DCF model assumes an annual dividend and a constant dividend growth rate. [11] The DCF model equates a common stock's price, *P*, to the present value of the stock's expected stream of future annual dividends, D_1, which grow at the constant rate, *g*, and are discounted at the investor-required rate of return, *k*. The formula can be rewritten to solve for, k, as follows:

$$k = \left[\frac{D_1}{P_0}\right] + \mathrm{g}$$

Where *k* is also called the cost of common equity, D_1 is the expected dividend, P_0 is the current stock price, and *g* is the expected growth rate in dividends. Most companies pay dividends quarterly (a few semi-annually), however, so the cost of common equity calculation was adjusted by the ICC to reflect the greater frequency of dividend payments for *n* periods per year for the applicable company.[12] For a company that pays dividends quarterly for example, its quarterly dividend yield ($\frac{D_1}{P_0}$) is added to its forecasted growth rate *g* (converted to a quarterly rate) to

[11] The seminal constant growth annual DCF model was developed by Dr. Myron Gordon and is also referred to as the Gordon Model.
[12] Linke and Zumwalt (1984) also note the importance of reflecting more frequent dividend payments and adjust the Gordon model to calculate a firm's cost of equity. They go a step further than the ICC by adding to the quarterly DCF model a time value of money component to recognize that dividends received earlier are accorded greater value than those paid later in the year.

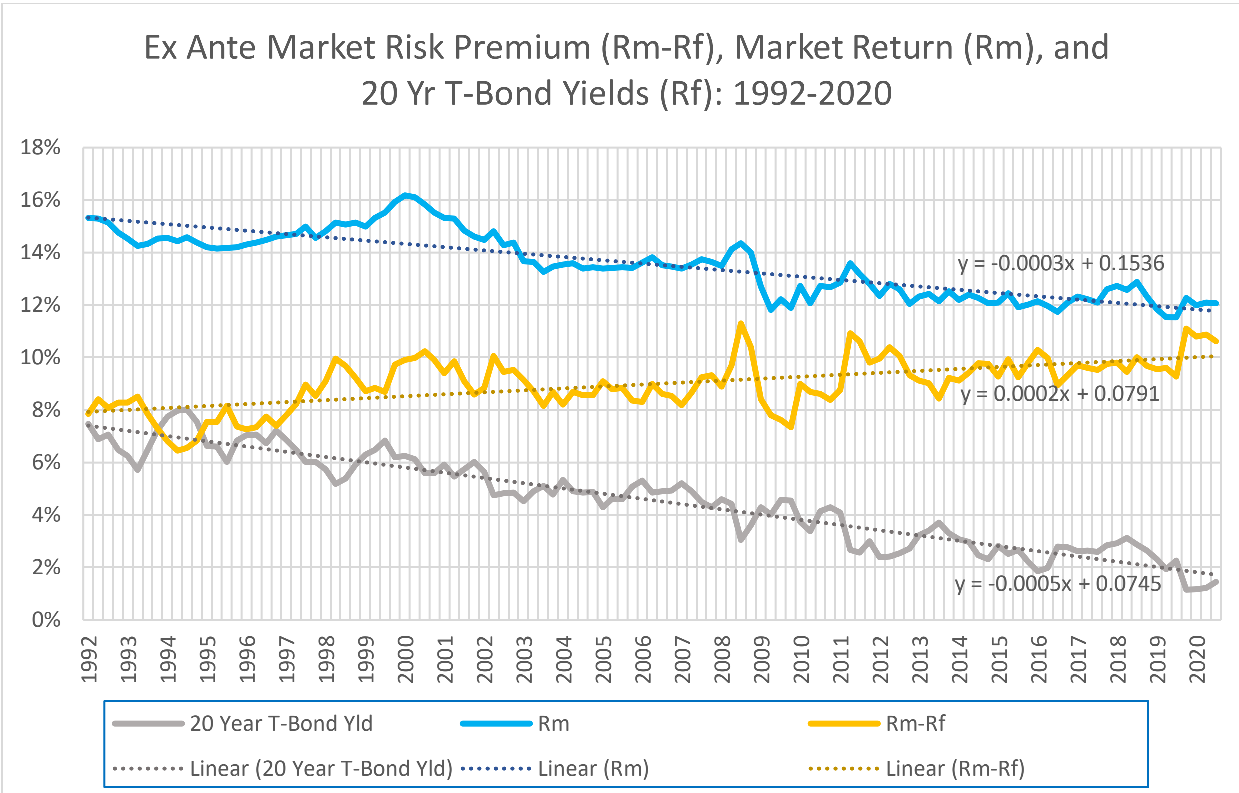
determine the quarterly *k* which is then annualized. As each DCF calculation was made as of the end of each quarter, the stock price used by the ICC is the closing price as of each respective quarter-end. The growth rate is the current three- to five-year consensus analyst earnings growth forecasts as of the quarter-end as reported primarily from the Institutional Brokerage Estimation Survey (I/B/E/S) and secondarily from Zacks Investment Survey (Zacks) from 1992 to 2003. This was later replaced in 2004 with the three- to five-year consensus analyst earnings growth forecasts primarily from Zacks and secondarily from Yahoo! (2004-2009) or Reuters (2010-2020). Dividend data is primarily from the S&P Stock Guide and secondarily from Zacks, Morningstar, or company websites and measured as of the quarter-end. Firms not paying a dividend as of the end of the quarter, or for which neither Zacks nor Reuters growth rates were available, were eliminated from the analysis. The resulting company-specific estimates of the expected rate of return on common equity were then weighted using market value data from Zacks (from 2004 onwards; prior to 2004, market value data was from Salomon Brothers Performance and Weights of the S&P500 (1992-2002) and the Chicago Board of Options Exchange (2003-2004)).

To determine the *ex ante* quarterly market risk premium from 1992 through 2020, for each quarter-end market return calculated by the ICC, we subtracted the 20-year U.S. Treasury constant maturity yield as of the same date. We used a long-term U.S. Treasury bond yield to proxy the risk-free rate to more closely match the investment horizon for equities, which have similar implicit premiums for long-term inflation. The 30-year U.S. Treasury constant maturity yield was not used since they ceased to be issued from March 28, 2002 through December 30, 2005 and yield data was not available during that period.

2.2 ***<u>Market Risk Premium Empirical Results and Discussion</u>***

Figure 1 summarizes the forward-looking return on the market portfolio (*Rm*), the risk-free rate proxy (*Rf*, 20-year U.S. Treasury bond yields), and the *ex ante* market risk premia (*Rm-Rf*) over a 29-year period. The results indicate *ex ante* market risk premium estimates (EMRP)

Figure 1



peaked at 11.30% in 2008 Q1 and reached a nadir of 6.45% in 1994 Q3. We initially observe that (1) our EMRP estimates are much higher than historical *ex post* equity risk premia, implied equity risk premia, and EMRP estimates for periods that extended through 1991 (see, for example, Brigham, Vinson and Shome, 1985 or Harris and Marston, 1992) as discussed in the review of literature; (2) the EMRP estimates fluctuate over time; (3) while not a strong trend, it has generally been increasing over the 29-year period; (4) there is no substantial difference in the 5-year, 10-year or 29-year average EMRP estimates; (5) all EMRP estimates are positive and never at zero; and (6) our EMRP estimates are closer to those reported by Harris and Marston

(2013) of 5.57% to 10.46% for the period 1986-2010 compared to other published estimates we reviewed.

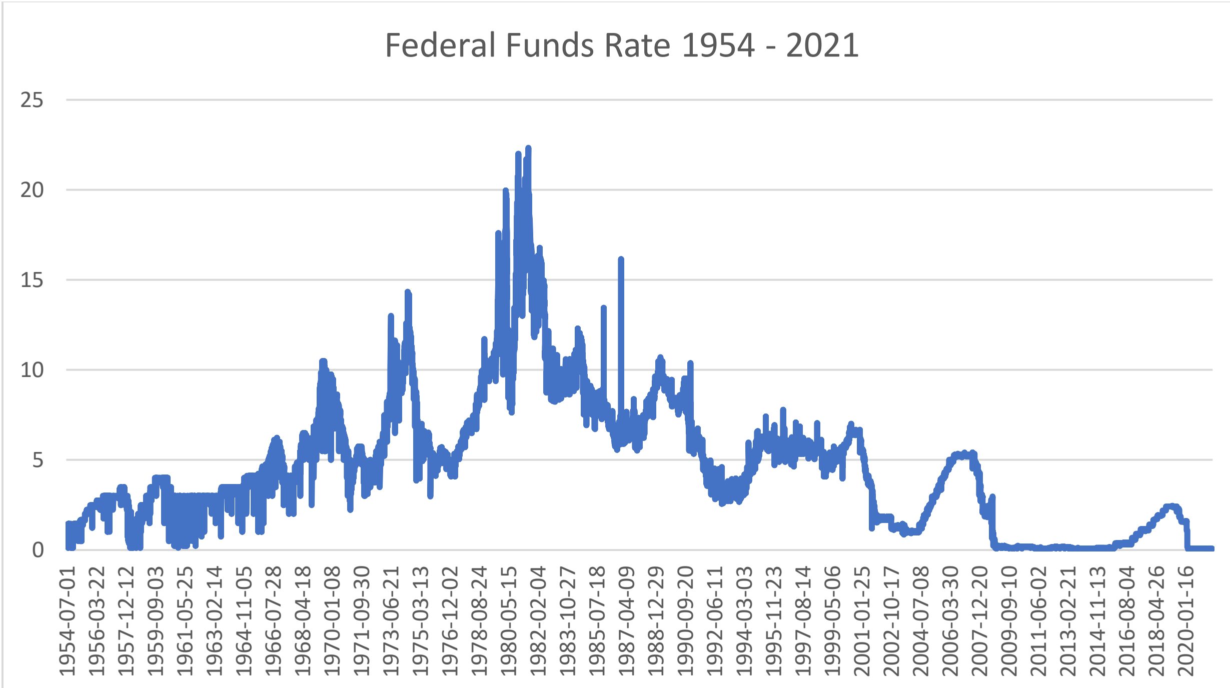
There were three recessionary periods during this time frame: (1) March to November 2001, (2) December 2007 to June 2009, and (3) February to April 2020.[13] The EMRP was at or above 9% during all three recessions and hovered very near or exceeded 9% consistently since mid-2011 (except for one quarter in 2013). The EMRP was consistently above 10% in 2020 and exceeded 11% in just two quarters, both during a recession: 2008 Q4 and 2020 Q1.

While we investigate the relationships of the EMRP to macroeconomic factors such as GDP growth and interest rates later, Figure 1 suggests a strong negative relationship between the EMRP and interest rates. Since the market risk premium is the excess market return above the risk-free rate (as proxied by the long-term government bond yield) that investors expect, historically low interest rates have likely had an outsized impact on the *ex ante* market risk premia. Figure 1 shows long-term interest rates declining at a faster rate than equity returns. We note that in response to the 1991 recession, the Federal Funds rate[14] began to drop in 1992, increasing in 1994-2000, and again sinking to new lows thereafter except in 2005-2007 as shown in Figure 2:

[13] National Bureau of Economic Research at https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions.

[14] The Federal Funds rate is a short-term rate at which banks borrow money from each other overnight and is also indicative of the Federal Reserve's money policy which, in turn, affects all other prevailing interest rates.

Figure 2



The Federal Funds rate was below 1% during the 2007-2009 recession and sank to 0.09% by December 2020 (for perspective, the last time prior to 2008 that the Federal Funds rate went below 1% was in 1954).[15] Thus, the higher observed EMRPs from 1992 to 2020 compared to those reported in the literature from the 1960s through the early 1980s is not necessarily indicative of an increasingly risky equity market from which investors demanded a higher risk premium; rather, it likely reflects the low interest rate environment of the early1990s that further declined close to zero beginning in 2008. Duarte and Rosa (2015) conclude similarly from their study of twenty equity risk premium models that the higher equity risk premia it observed in 2012 to 2013 are due to government bond yields being unusually low and not because investors expected high stock returns.

[15] The Federal Funds rate climbed above 1% from about mid-2017 through early March 2020. Data in Figure 2 from the *Federal Reserve Bank- H.15 Selected Interest Rates*.

Comparison of Ex Ante and Ex Post Market Risk Premia

Unlike historical *ex post* risk premium estimates (HRP), e*x ante* EMRPs don't need to be averaged to be applied in financial models as they are measured by a date certain using the most current forward-looking market inputs as of that date (e.g., spot stock price, most current financial analyst growth rate forecast). We nonetheless calculated the EMRP arithmetic and geometric average and the commensurate standard deviation (SD) and standard error (SE) over various time periods to allow comparisons to the HRPs. Table 1 shows our EMRPs have a small standard deviation of at or below 1% and even smaller standard errors.

Table 1 - *Ex Ante* Equity Risk Premium (Equity Return - US 20-year T-bond)

Period	**Arithmetic Avg**	**SD**	**SE**	**Geometric Avg**
1992 to 2020 (29 years)	8.98%	1.00%	0.09%	8.92%
2001 to 2020 (20 years)	9.31%	0.80%	0.09%	9.27%
1992 to 2000 (9 years)	8.25%	1.02%	0.17%	8.18%
2001 to 2010 (10 years)	8.90%	0.75%	0.12%	8.87%
2011 to 2020 (10 years)	9.71%	0.65%	0.10%	9.69%

We compare these EMRPs to the HRPs in Damodaran (2021) in Table 2 and note that while the HRP average risk premiums are smaller, the standard errors are much larger. Looking at the most recent 10-year period (2011 to 2020), the risk premium averages for both methods are close but the EMRP's standard error is 0.10%, indicating greater estimate precision, compared to 4.81% for the HRP. For the period 1928 to 2020, the HRP standard deviation is 21.01%, dropping to 15.21% for the much shorter period of 2011-2020. These standard deviations are approximately 15 to 21 times greater than the EMRP standard deviation for any of the 10-, 20- or 29-year periods (i.e., 0.65% to 1.02%). These large swings in the HRP suggest *ex ante* EMRPs are preferable to use over HRPs for financial analyses as they are far more stable. They fluctuate in a relatively narrow band, although rising more during recessionary periods.

Table 2 - *Ex Post* Equity Risk Premium (Equity Return - US 10-yr T-bond) [16]

Period	Arithmetic Avg	SD	SE	Geometric Avg
1928 to 2020 (93 years)	6.45%	21.01%	2.18%	4.87%
1971 to 2020 (50 years)	4.94%	19.09%	2.70%	3.95%
2011 to 2020 (10 years)	9.90%	15.21%	4.81%	9.56%

CAPM Implications

A higher market risk premium mathematically produces a higher cost of equity estimate when using the CAPM, all else equal. Experience tells us, however, that all else is rarely equal. While widely used, the CAPM is not the only financial model used in investment allocation, corporate finance, and public utility regulatory decisions. Depending upon the practitioner, different model results might be accorded different weights or given equal weight (i.e., averaging). Thus, it is not a foregone conclusion that using an *ex ante* market risk premium would result in a higher cost of equity estimate than other models. For example, in a recently concluded ICC public utility rate case, ICC Staff's cost of equity analysis using the *ex ante* EMRP produced a CAPM estimate (9.18%) that was lower than the constant growth DCF model estimate (9.45%)[17]. By reflecting investors' current expectations, using the current EMRP in cost of equity analysis has the advantage of excluding the "noise" incorporated in historical averages that represent information that is likely no longer relevant to investors and the market as a whole.

2.3 ***Macroeconomic Variables***

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[16] Damodaran (2021). The values were calculated by the authors using Dr. Damodaran's data.
[17] ICC Docket No. 20-0308, ICC Staff Exhibit 4.0 Schedules 4.05 and 4.06. After considering all parties' cost of equity estimates, the ICC Final Order adopted an authorized cost of equity of 9.67%.

Our study examines the relationship of the following macroeconomic variables to the *ex ante* EMRP from 1992 to 2020: (1) long-term interest rates using 20-year U.S. Treasury bond yields, (2) market volatility using the Market Volatility Index (VIX), (3) actual real GDP growth, (4) expected real GDP growth, (5) actual inflation as measured by the Consumer Price Index for all urban customers (CPI-U), (6) expected inflation over five and 30 years, and (7) the term spread between 20-year U.S. Treasury bond yields and the one-year U.S. Treasury bill yield. We used publicly available data for the macroeconomic variables and individually regressed them against the forward-looking EMRP we developed using the forward-looking market returns calculated by the ICC. The 20-year U.S. Treasury bond yield and one-year U.S. Treasury bill yield constant maturities were from the Federal Reserve Bulletin H.15; the CBOE Volatility Index (VIX) prices were from the Wall Street Journal's website (*https://www.wsj.com/market-data/quotes/index/VIX/historical-prices*); the actual real GDP growth rates were from the Bureau of Economic Analysis; the expected real GDP growth rates were the mean forecasts from the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters; the actual inflation CPI for all urban customers were from the Bureau of Labor Statistics; and the 5-year and 30-year expected inflation forecasts were from the Federal Reserve Bank of Cleveland.[18]

2.4 ***Market Risk Premium and Macroeconomic Factors Empirical Results and Discussion***

Table 3 below shows the resulting Pearson correlation coefficients (*P*) between the EMRP and the seven macroeconomic factors studied. Table 4 shows the linear regression t-statistics for the intercept and slope for each macroeconomic factor regressed against the EMRP and the

[18] Expected inflation data is provided by the Federal Reserve Bank of Cleveland as of the first day of each month instead of per quarter. Thus, the data point on the last month of each quarter was used to represent that quarter. This ensures the most recent expected inflation data available to investors as of the quarter-end matches up to the DCF model inputs for the forward-looking *Rm* calculations that were measured as of the same quarter-end.

significance F values. Looking only at the 29-year period, we find that the *ex ante* market risk premium has: (1) a statistically significant strong negative correlation to long-term government bond yields (*P*= -0.745, R^2= 0.555, t = -11.93) consistent with the findings of Brigham, Shome and Vinson (1985) and Harris and Marston (1992, 2001, 2013); (2) a statistically significant strong negative correlation to expected inflation regardless of a short or long forecast horizon (5-year horizon *P*= -0.673, R^2 = 0.453 v t = -9.72; 30-year horizon *P*= -0.684, R^2 = 0.467, t = -10); and (3) a statistically significant positive correlation to stock market volatility (*P*= 0.465, R^2= 0.216, t = 5.61) consistent with Kim, Morley and Nelson (2004). For the same 29-year period we also find no strong correlation between the *ex ante* market risk premium and (1) actual inflation (*P*= -0.169, R^2= 0.029); (2) actual GDP growth (*P*= -0.197, R^2= 0.039); (3) forecasted GDP growth (*P*= -0.148, R^2= 0.022); or (4) the interest rate term spread over the 29-year period (*P*= -0.134, R^2= 0.018).

Table 3. Correlation Coefficients and R-square between Ex Ante Equity Risk Premium and Macro Economic Variables

	Period =	29	20	9	10	10	4	5	5	5	5	5
	Years =	1992-2020	2001-2020	1992-2000	2001-2010	2011-2020	1992-1995	1996-2000	2001-2005	2006-2010	2011-2015	2016-2020
Rm and 20 Year T-Bond Yield												
CORRELATION COEFFICIENT		0.835	0.770	(0.249)	0.543	0.396	0.400	(0.433)	0.698	0.123	0.076	0.415
R-SQUARED		0.697	0.594	0.062	0.295	0.157	0.160	0.188	0.488	0.015	0.006	0.172
Equity Risk Premia and 20-Year T-Bond Yield												
CORRELATION COEFFICIENT		(0.745)	(0.656)	(0.842)	(0.231)	(0.805)	(0.810)	(0.838)	0.060	(0.569)	(0.793)	(0.824)
R-SQUARED		0.555	0.430	0.709	0.053	0.647	0.655	0.703	0.004	0.324	0.629	0.679
Equity Risk Premia and Market Volatility Index (VIX)												
CORRELATION COEFFICIENT		0.465	0.467	0.619	0.681	0.662	(0.314)	0.547	0.782	0.692	0.616	0.792
R-SQUARED		0.216	0.218	0.383	0.464	0.438	0.098	0.299	0.611	0.479	0.379	0.627
Equity Risk Premia and Actual Real GDP												
CORRELATION COEFFICIENT		(0.197)	(0.170)	0.024	(0.681)	(0.056)	(0.189)	(0.140)	(0.730)	(0.784)	(0.035)	(0.078)
R-SQUARED		0.039	0.029	0.001	0.464	0.003	0.036	0.020	0.533	0.614	0.001	0.006
Equity Risk Premia and Forecasted Real GDP												
CORRELATION COEFFICIENT		(0.148)	(0.180)	0.211	(0.591)	(0.118)	(0.252)	0.485	(0.570)	(0.697)	(0.256)	(0.141)
R-SQUARED		0.022	0.032	0.045	0.349	0.014	0.063	0.235	0.325	0.485	0.066	0.020
Equity Risk Premia and Actual Inflation (CPI-U)												
CORRELATION COEFFICIENT		(0.169)	(0.075)	(0.105)	(0.066)	0.166	0.193	0.015	(0.073)	(0.087)	0.154	0.094
R-SQUARED		0.029	0.006	0.011	0.004	0.028	0.037	0.000	0.005	0.008	0.024	0.009
ERP vs 5-year Expected inflation												
CORRELATION COEFFICIENT		(0.673)	(0.554)	(0.586)	(0.210)	(0.582)	(0.705)	(0.416)	(0.000)	(0.404)	(0.548)	(0.726)
R-SQUARED		0.453	0.307	0.343	0.044	0.339	0.497	0.173	0.000	0.163	0.301	0.526
ERP vs 30-year Expected inflation												
CORRELATION COEFFICIENT		(0.684)	(0.569)	(0.629)	(0.175)	(0.604)	(0.662)	(0.505)	(0.074)	(0.380)	(0.578)	(0.724)
R-SQUARED		0.467	0.324	0.395	0.030	0.364	0.439	0.255	0.005	0.144	0.334	0.524
ERP vs Term Spread (20-yr T-Bond less 1-yr T-Bill)												
CORRELATION COEFFICIENT		(0.134)	(0.248)	(0.422)	0.006	(0.445)	0.491	(0.783)	(0.032)	(0.021)	(0.728)	0.018
R-SQUARED		0.018	0.061	0.178	0.000	0.198	0.241	0.613	0.001	0.000	0.530	0.000

Table 4. Linear Regression Significance F Values and T-Statistics: 1992-2020 Equity Risk Premium and Independent Variables[1]				
Independent Variable *(x)*	Pearson R	Significance F Value	Intercept *(a)*	Slope *(b)*
20-Year T-Bond Yield	(0.745)	0.00	0.11	(0.42)
T- Statistic			*62.52*	*(11.93)*
Market Volatility Index (VIX)	0.465	0.00	0.08	0.00
T- Statistic			*35.84*	*5.61*
Actual Real GDP	(0.197)	0.03	0.09	(0.00)
T- Statistic			*87.82*	*(2.14)*
Forecasted Real GDP	(0.148)	0.11	0.09	(0.00)
T- Statistic			*83.94*	*(1.60)*
Actual Inflation (CPI-U)	(0.169)	0.07	0.09	(0.15)
T- Statistic			*45.44*	*(1.83)*
5-year Expected Inflation	(0.673)	0.00	0.11	(0.95)
T- Statistic			*47.52*	*(9.72)*
30-year Expected inflation	(0.684)	0.00	0.13	(1.57)
T- Statistic			*31.98*	*(10.00)*
Term Spread (20-yr T-Bond less 1 yr T-Bill)	(0.134)	0.15	0.09	(0.11)
T- Statistic			*53.30*	*(1.44)*

[1] *95% confidence level, linear regression formula y = a + bx;*

Our finding of a statistically significant negative correlation between the *ex ante* equity risk premium and long-term government bond yields is consistent with the literature discussed earlier. Although the observed negative correlation between the *ex ante* equity risk premium and expected inflation over the 29-year period might appear counterintuitive, we note that the risk-free rate (which is subtracted from the market return to calculate the market risk premium) is proxied by the long-term government bond yield which is a nominal rate. A nominal rate is composed of the real risk-free rate and a premium for expected inflation. Thus, holding all else equal, higher expected inflation would result in a higher risk-free rate, *Rf*, which when subtracted from the market return, *Rm*, would result in a lower *ex ante* market risk premium --- a negative correlation. In the decade of 2001-2010, however, a much weaker negative correlation between the equity risk premium and the 30-year (P= -0.175, R^2= .030, t = -1.09) and 5-year expected inflation (P= -0.210, R^2= .044, t = -1.32) is observed. Drilling down to the first five years of that decade (2001 to 2005), the correlation between the *ex ante* equity risk premium and the 30-year expected inflation drops to near zero, and to zero against the 5-year expected inflation rate. We further note that in the same 2001-2005 period, the *ex ante* equity risk premium likewise had a near zero correlation with long-term government bond yields despite a strong negative correlation over the much longer 29-year period. Similarly, despite no strong correlation of the *ex ante* equity risk premium with actual or forecasted GDP growth from 1992-2020, there was a statistically significant strong negative correlation in 2001-2005 (actual real GDP P= -0.730, R^2= 0.533, t = -4.53; and forecasted GDP growth P= -0.570, R^2=0.325, t = - 2.95). We note that this five-year period was marked by the Internet bubble implosion, a steep decline in equity prices worldwide, the 2001 recession that led to annual negative returns on the S&P 500 in 2001 and 2002[19], and a massive increase in government security-related spending as a result of the 9/11 attacks in the U.S. This period is also during an overall downward trend in interest rates and actual inflation. All of this suggests that during periods of high market volatility coupled with a low interest rate and low inflation environment, investors' return expectations are influenced more strongly by uncertainty in economic growth. This also applies to the 2001 to 2010 decade which experienced two recessions (March to November 2001 and December 2007 to June 2009). Although the 29-year period shows no strong correlation between the *ex ante* equity risk premium and forecasted GDP growth or actual GDP growth, the decade of 2001 to 2010 shows a statistically significant strong negative correlation for actual GDP growth (P = -0.681, R^2= 0.464, t = -5.74) and forecasted GDP growth (P = -0.591, R^2= 0.349, t = -4.52). The negative relationship means that as current or forecasted GDP growth improves, the market risk premium expected by investors decline--- most likely because of the improved market return outlook which in turn reduces investors' perceived risk.

Our study's finding that the *ex ante* market risk premium has a statistically significant positive correlation to stock market volatility is also consistent with the literature and the basic risk and return premise that higher risk (of an asset) translates to higher expected returns (from

[19] S&P 500 returns by year data from Dr. A. Damodaran's website at: http://www.stern.nyu.edu/~adamodar/New_Home_Page/data.html.

that asset). A risk premium for market volatility is priced into current asset values resulting in higher expected returns. This is a strong argument against using historical *ex post* market risk premiums since they don't reflect current market volatility conditions that in turn affect investor's current return expectations. This is also consistent with Koutmos (2015) who notes historical mean returns are a poor proxy for the unobservable investors' expected risk premium which are based on current volatility and news regarding future volatility.

The correlation coefficients for another five-year data subset also indicated an unexpected result. While the EMRP has a positive correlation to stock market volatility (VIX) over the 29-year period, it was negatively correlated from 1992-1995 (P= -0.314, R^2= 0.10, t = -1.24). It flips back to a positive correlation in the next five-year period and generally strengthens thereafter. Despite the relatively low t-statistic, we nonetheless wondered why it appears investors did not demand a higher equity risk premium as market volatility increased in the 1992-1995 period? In early 1994, we note that the Federal Reserve increased the Federal Funds rate five times in increments of a quarter or a half-percentage point and then increased it by another 0.75% by November 1994. The rate was notched up by another half percent in February 1995. The Federal Reserve's aggressive reversal of its low interest rate policy during the latter part of this four-year period likely caused investors to stay on the sidelines such that when interest rates finally stopped rising, an influx into equities resulted in the stellar realized market return of 37.20% in 1995 (compared to 1.33% the prior year), as seen in data from Damodaran.[20] This confluence of atypical events, particularly the strong market rebound in 1995 due to the abatement of interest rate risk, may have led to the temporary negative correlation observed between the *ex ante* equity risk premium and market volatility.

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[20] S&P 500 returns by year data from Dr. A. Damodaran's website at: http://www.stern.nyu.edu/~adamodar/New_Home_Page/data.html.

Our study indicates no strong long-term correlation between actual inflation and the equity risk premium which is the opposite of Kyriacou, Madsen and Mase's (2006) findings. While the difference can be attributed to the differing sample and measurement period, our study's use of *ex ante* equity risk premiums instead of *ex post* equity risk premiums as employed by Kyriacou, et al (2006) may have likewise played a large role. As discussed in this paper, *ex post* market risk premia rely on realized market returns and, therefore, do not capture investors' current return expectations that are based on the current outlook for macroeconomic factors relevant to the formation of such market return expectations.

3. Conclusions

The forward-looking *ex ante* market risk premium is the theoretically correct input for estimating a firm's cost of equity using the CAPM. Our study shows forward-looking market risk premia exhibit lower standard deviations so they are more stable than, and thus preferable to, the historical *ex post* market risk premium which relies on average realized equity returns over an arbitrarily selected measurement period. The *ex post* market risk premium can substantially vary based on the beginning and ending period arbitrarily chosen by the practitioner. In contrast, the *ex ante* market risk premium does not require selecting an arbitrary historical period, which reduces estimate bias. An *ex post* market risk premium measured over several decades would also give less weight to the lower interest rates that have prevailed since the dawn of the 21st century. The *ex ante* market risk premium avoids that problem altogether as it reflects investors' current return expectations of relevant macroeconomic factors such as inflation and interest rates.

We also examine the relationship of the *ex ante* market risk premium to various macroeconomic factors that other studies have examined often with *ex post* equity risk premia. We find that from 1992 through 2020 the *ex ante* market risk premium has (1) a statistically significant strong negative correlation to long-term government bond yields, (2) a statistically significant strong negative correlation to expected inflation (over a 5-year or a 30-year horizon), (3) a statistically significant positive correlation to stock market volatility, and (4) has no strong correlation with actual inflation, actual GDP growth, forecasted GDP growth, or the term spread between the 20-year U.S. Treasury bond and the one-year U.S. Treasury bill. Our findings on the long-term relationship between the equity risk premium and long-term government bond yields, expected inflation, or stock market volatility are consistent with the literature. Certain short-term periods had correlation coefficients that stood out as they were not consistent with those observed for the 1992-2020 period. For example, in the decade beginning in 2001 (particularly in the first five years) that was marked by two U.S. recessions and global disruptions, the observed correlation coefficients between the *ex ante* market risk premium and either expected inflation or long-term government bond yields were negative, but notably much weaker compared to the coefficient for 1992-2020. In another example, the decade that began in 2001 had a strong negative correlation between the *ex ante* market risk premium and actual or forecasted GDP growth despite a weak negative correlation for the longer 1992-2020 period. This suggests that during periods of high market volatility coupled with a low interest rate and low inflation environment, investors' return expectations are strongly related to economic growth prospects, requiring less of a premium as the economic outlook improves.

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