Implied risk premia in online financial data

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ABSTRACT

We lift data from online sources to replicate the actions of an unsophisticated investor trying to determine an appropriate cost of equity. We then use this data in two pricing models to determine implied equity risk premiums for S&P 500 stocks on a random date. Our results indicate that implied premiums computed using online data vary widely from 7.07% to 25.16%. We recommend that investors utilize caution when lifting data from the world-wide-web. Our work also suggests that blindly lifting data can cause problems in other ways.

Keywords: Cost of Equity, Risk Premia, Online Data

INTRODUCTION

This paper is a thought experiment in that we assume the mentality of an individual retail investor who often just grabs data from online sources. This data is easy to obtain and often offered at no charge. The purpose of this paper is to see whether using this free data is warranted – or whether the user should exercise caution when relying on it for stock price estimation.

The cost of equity capital – also known as the shareholder's required return – is crucial along many dimensions. First, it is imperative for determining the price an investor is willing to pay for a share of stock. Second, it is instrumental in determining an appropriate discount rate for use in capital budgeting exercises. Finally, the question of overall market efficiency hinges on whether or not the return an investor receives is compensation for the risk taken by the investment.

Academics endeavor to estimate the cost of equity in all manner of ways. We throw the kitchen sink on the right-hand side of an asset pricing formula hoping to capture all types of risk (size, book-to-market, momentum, etc.). Or, if you like, we try to capture investor behavioral characteristics whose patterns are predictable and priced. We regress actual historical excess returns on explanatory terms over a 60-month period to obtain coefficients that help predict the return we should expect in the future.

But investors not considered "smart money" do not go to such great extremes. In fact, Graham and Harvey (2001) find that 73.5% of surveyed corporate CFOs use the basic CAPM, but this result is driven by larger firms. CFOs of smaller firms determine their cost of equity capital by "what investors tell us they require." Certainly not as sophisticated. Only the most sophisticated firms use a multifactor/multibeta CAPM – and when they do, they do not typically use size or book-to-market.

A firm's size was determined to be related to stock returns initially by Banz (1981). A firm's stock returns were also found to be related to book-to-market equity by Stattman (1980) and Rosenberg, Reid, and Lanstein (1985). The joint effect of the two metrics was determined by Fama and French (1992) who test size and book-to-market simultaneously with other insignificant factors. Later, Jegadeesh and Titman (1993) also found price momentum in 3 to 12-month trading strategies that could not be accounted for by traditional factors associated with risk. Carhart (1997) was the first to include this momentum in the asset pricing model he used to test mutual funds. Again, only the largest firms pay any attention to these innovations. On average, smaller firms and individuals do not.

Graham and Harvey find that CFOs do not often use the dividend discount model [DDM]. In fact, only about 14% of surveyed firms report using it. This contrasts with earlier studies like Gitman and Mercurio (1982) who find that 31.2% of Fortune 1000 respondents use the DDM to estimate the cost of equity capital. Perhaps the use of the DDM is waning through time, but that is the subject of another debate.

To replicate the simpler way in which smaller firms and individual investors quickly and easily calculate their required returns, we lift data from online sources – mainly Yahoo! Finance (http://finance.yahoo.com). We then equate the market-model and the DDM using said data. Doing so allows us to see what the online data is saying about the risk premiums implied in the published numbers. Our results vary widely – from an average implied equity risk premium of 7.07% to 25.16%. As a comparison, the average annual risk premium for the 120 years from 1900 to 2015 was 7.8% (average market return [S&P 500] of 11.5% minus the average three-month treasury-bill rate of 3.7%) (Brealey, Myers, Allen (2016)). Our finding suggests that users of online data should exercise caution when estimating their cost of equity capital. We find other problems too – specifically we note inconsistencies in several financial metrics posted on Yahoo! Finance.

DATA AND METHODOLOGY

Our goal is to replicate a “naïve” means of collecting data and using it in the most basic of estimates for the cost of equity.

The first cost of equity calculation we consider is the Gordon Growth Model [GGM] – an elegant three-variable expression of the broader Dividend Discount Model [DDM] published in Gordon and Shapiro (1956):

$$r = \frac{Div_1}{P_0} + g \qquad (1)$$

The second cost of equity calculation we consider is the CAPM of Sharpe (1964) and Lintner (1965):

$$r = r_f + \beta(r_m - r_f) \qquad (2)$$

Both equation (1) and equation (2) are estimates of the same financial metric – the cost of equity capital. Equating them yields the following and its rearrangement:

$$\frac{Div_1}{P_0} + g = r_f + \beta(r_m - r_f)$$

$$(r_m - r_f) = \frac{1}{\beta}\left[\frac{Div_1}{P_0} + g - r_f\right] \qquad (3)$$

Equation (3) specifies the implied equity risk premium. This equation is the basis of our study.

On April 21, 2016, online equity data was collected from the Yahoo! Finance website for common equity of the S&P 500 Index by coding a spreadsheet program to pull the data from the world-wide-web. The data collected online is summarized in Table 1.

[Insert Table 1 Here]

The number of stocks in our sample is 503. This may seem odd at first glance since we are collecting data on the S&P 500. At the time of data download there were certainly 500 firms in the S&P 500, but Standard and Poor’s had included two different share classes of four separate companies. S&P included both A and B shares of Twenty-First Century Fox, both A and C shares of Discovery Communications, both A and C shares of Alphabet Inc., and both A and B shares of News Corp. With data unavailable for one of the 504 stocks, the final sample size is 503.

Beta “*b*” is taken directly from Yahoo! Finance. The mean beta for S&P 500 firms is 1.07 – about what one would expect if the S&P 500 Index was used as a proxy for the market portfolio.

“Div_1/P_0”is the dividend yield stated on Yahoo! Finance. The mean dividend yield is 1.99%. Of the 503 firms in the sample, 417 pay dividends and 86 do not. Here we encounter our first strange observation about the Yahoo! data. Within our sample of 503 stocks from the S&P 500, 36 of the stocks were listed with a 0.00% Payout Ratio but also having a non-zero Dividend

Yield. The payout ratio from Yahoo! also looks problematic. The minimum payout ratio of 0.00% is expected. The maximum payout ratio of 1,864.54% seems extreme.
For "g" we form five separate measures:

- We define "g_1" as the average analyst growth estimate provided on Yahoo! Finance. For our sample of S&P 500 firms, the average g_1 is 7.47%.
- "g_2" is the implied growth rate via the firm's PEG ratio. We define $g_2 \equiv ((\text{P/E}) \div (\text{PEG Ratio}))$ where P/E is the trailing twelve-month price-to-earnings ratio listed on Yahoo! Finance and the PEG Ratio is the PEG listed on Yahoo! Finance. Since a firm's PEG ratio is the P/E ratio divided by their growth rate, dividing the P/E by the PEG yields an implied growth rate. The mean g_2 of the sample is 21.10%.
- The next growth measure "g_3" is implied growth via the firm's PEG ratio and implied P/E ratio. We define $g_3 \equiv ((\text{P/E}) \div (\text{PEG Ratio}))$. Again, in the denominator we use the PEG ratio reported on Yahoo! Finance – as we did in g_2. But the P/E in the numerator is calculated as the closing share price listed on Yahoo! Finance divided by the EPS listed on Yahoo! Finance. Table 1 demonstrates how g_2 and g_3 are similar – but not equivalent. The mean g_3 of the sample is 20.10%.
- Our fourth measure, "g_4", is calculated as the firm's Sustainable Growth Rate ($g_4 \equiv \text{ROE} * \text{Retention Ratio}$). ROE is taken directly from Yahoo! Finance. The Retention Ratio is 1 minus the Payout Ratio listed on Yahoo! Finance. (Note: The Retention Ratio is also often referred to as the Plowback Ratio.) The average g_4 is 11.90%.
- Finally, "g_5" is calculated as the firm's Internal Growth Rate ($g_5 \equiv \text{ROA} * \text{Retention Ratio}$). Again, ROA is taken from Yahoo! Finance and the Retention Ratio is 1 minus the Payout Ratio listed on Yahoo! Finance. The mean g_5 is 3.60%.

The interest rate on treasuries "r_f" was taken from bankrate.com. All reported results include the interest rate on the "1-year Treasury Constant Maturity." We replicated all results using both the 5-year and 10-year treasury note interest rates. The results remain effectively unchanged.

With regard to risk, Table 1 illustrates relative consistency across the sample. Non-dividend firms appear to have more risk than dividend payers with a beta of 1.58 compared to 0.97; however, the median values do not differ much – indicating that outliers are influencing this comparison. The beta of non-dividend paying firms has a much higher standard deviation supporting this observation.

There are large economic differences between dividend paying stocks versus non-dividend paying stocks when it comes to all but one of the five measures of growth. With the exception of g_4, non-dividend paying stocks have substantially higher growth rates than dividend payers.

After collecting all relevant data, we compile results for Equation (3) for given combinations of the metrics detailed above.

RESULTS

Panels A through E of Table 2 detail the mean implied equity risk premiums from Equation (3) – each for the five specifications of growth rate described above.

For g_1 (Analyst 5-year estimate from Yahoo! Finance), the mean implied risk premium (RMRF) is 13.05% (see Panel A). It is important to recall that g from the GGM is the expected growth rate of dividends in a growing perpetuity. While an infinite horizon *g* is called for, analysts 5-year estimate is the longest piece of consensus data available. This makes the 13.05% a noisy result – and not statistically significant. Non-dividend payers' premium of 15.97% exceeds the 12.47% of dividend paying stocks. In a typical study, the lack of significance would be of great concern. But remember – we are attempting to mimic what an unsophisticated investor might do, and the most probable course of action for that investor would be to simply grab numbers from the web without a second thought. They wouldn't be concerned with statistical significance; rather, they would just treat the metric as gospel and move on. In fact, we would argue that g_1 is the most probable metric they would use because someone has already done the hard work for them – the thought process being "The analysts know more than me. I'll just lift their number and move on instead of doing the calculations required in g_2 to g_5." So, we argue that metric most likely used by investors is g_1.

As discussed, g_2 and g_3 are related in the sense that they both use the Yahoo! reported PEG ratio. The difference is in the numerator. g_2 uses the P/E Ratio specified by Yahoo! while g_3 uses Yahoo!'s reported price and reported earnings (for the trailing twelve months). We expected their results to be similar, and they are. From Panel B and C, g_2 results in an average premium of 25.16% while the average premium using g_3 is 23.19%. The medians are almost identical. There is a bit more of a difference in the dividend and non-dividend subsample (19.09% to 16.02% [dividends] and 55.27% to 58.77% [no dividends] respectively) with the non-dividend stocks having an incredibly high standard deviation.

The sustainable growth rate captured in g_4 results in a mean premium of 15.60% for the full sample. Average premiums for the dividend and non-dividend subsamples do not differ much at all from this premium.

Finally, the internal growth rate of g_5 yields an average RMRF of 7.07% (t=3.35) with an even lower median of 4.98%. The dividend payers (6.26% average) and non-dividend payers (11.11% average) differ substantially as well.

At this point, we must ask the question, "what drives risk premiums to be higher or lower?" Conventional wisdom dictates that a higher aggregate level of collective risk aversion drives risk premiums up, and lower levels of risk aversion result in smaller premiums. Uniformly, all five measures of the risk premium of non-dividend paying firms are higher than that of dividend payers – regardless of which *g* metric we use. We can reasonably infer investors are more risk averse to non-dividend paying firms and require a higher premium to compensate them for this risk. Again, the median beta for dividend payers (0.97) and non-dividend payers (1.58) are substantially different.

ROBUSTNESS CHECKS AND EXTENSIONS

Industry/Sector Effects

We extend our analysis to see if market risk premia differ by industry. To do this, we take subsamples of the data based on the S&P Sectors that Standard and Poor's uses to mimic the economy. S&P forms these sectors on the basis of Global Industry Classification Standard (GICS®) – a classification developed by Morgan Stanley Capital International (MSCI) and S&P Dow Jones. Results for these subsamples are provided in Table 3.

At first glance, it is obvious that there is wide variability in implied premiums in different sectors. Energy provides the lowest implied premia with an average of 0.42% across the five measures of g. The Financial sector has the next lowest average implied premium of 7.16%. On the other end of the spectrum, Information Technology firms average a 30.22% premium over the five measures. Perhaps surprisingly, Utilities have the second highest average implied premium of 27.62%.

Within each sector, there is a pretty dramatic difference of implied premia depending on which specification of g is used. For example, using g_2, Communication Services has an implied premium of 16.58% while the value is 4.66% using g_5 (a difference of 11.92%). The largest variability within a sector is in Information Technology from 63.29% (g_3) to 6.08% (g_5).

There are a few industries for which the implied market risk premium is negative. This is completely incompatible with all asset pricing theory since investors would expect to earn a higher return on treasury securities than they would investing in the market of equities. Energy is the most troubling sector with negative premia for two of the measures of growth rate. One of the implied negative premia – using g_4 – is (18.13%)!

Actual Realized Premia

Finally, while it may be a bit troublesome equating the two models for expected return, we wanted to wait at least five years to see what the actual market risk premium was for the period in question. Which “g” was the best predictor? At the time of data collection, 1-year and 5-year treasury yields were 0.54% and 1.22% respectively (representing a “typical” upward-sloping yield curve). Again, this data was taken from bankrate.com.

The 1-year and 5-year holding-period returns on the S&P 500 from the date of data collection were 12.26% and 99.43% respectively. Since we examined results from a relatively odd date (April 21, 2016), market returns were calculated using SPDR ETF returns from Yahoo! Finance.

The actual one-year market premium subsequent to our study is therefore 11.72% (12.26% less 0.54%). The actual five-year annual market premium is 19.64% (99.43% less 1.22% divided by 5).

Growth rate g_1 best predicted the 11.72% 1-year actual market risk premium with an implied premium of 13.05% while the worst predictor was g_2 at 25.16% (see Table 2).

Using the 5-year period, g_3 and g_4 were almost equally as good at predicting the actual annual premium. g_3 under-estimated the annual premium by 4.04% (19.64% actual premium minus 15.60% implied) while g_4 overestimated it by 3.55% (23.19% implied minus 19.64% actual premium).

CONCLUSION

Using two common cost of equity specifications and various measures of growth with online data, we demonstrate that the resulting implied average risk premiums differ substantially. We also discover inconsistency problems with the dividend yield and payout ratio metrics posted on Yahoo!. If there is a takeaway from this paper to investors, the takeaway should be to use caution when utilizing financial data. Users of online data must be wary and vigilant in blindly lifting data without considering the unintended ramifications.

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Table 1 - Descriptive Statistics

This table provides summary statistics for financial data taken from Yahoo! Finance for S&P 500 stocks on April 21, 2016. A spreadsheet program was created to grab the information directly from the site to eliminate error.

Panel A. Full Sample

	N	Mean	Std Dev	Median	Min	Max
Beta	503	1.07	1.28	1.01	(0.72)	23.83
Payout Ratio	503	45.46%	96.59%	31.91%	0.00%	1,864.54%
Retention Ratio	503	54.54%	96.59%	68.09%	-1,764.54%	100.00%
Div_1/P_0	503	1.99%	1.54%	2.00%	0.00%	13.60%
ROA	503	6.21%	5.22%	5.57%	-13.52%	32.07%
ROE	503	24.81%	112.23%	14.09%	-142.07%	2,287.26%
PEG Ratio	503	(0.65)	86.53	1.76	(1,874.00)	413.00
P/E (ttm) Explicit	503	33.38	160.52	20.19	0	3,515.38
P/E (ttm) Implied	501	29.18	214.20	20.11	(1,102.14)	4,535.00
g_1	503	7.47%	25.28%	9.08%	-483.20%	127.30%
g_2	491	21.06%	169.45%	10.51%	-30.31%	3,739.77%
g_3	491	20.06%	221.01%	10.55%	-553.94%	4,824.47%
g_4	503	11.94%	60.20%	8.72%	-210.44%	1,135.62%
g_5	503	3.62%	5.32%	3.27%	-54.35%	28.75%

Panel B. Dividend Payers

	N	Mean	Std Dev	Median	Min	Max
Beta	417	0.97	0.49	1.00	(0.72)	3.85
Payout Ratio	417	54.71%	103.68%	39.61%	0.00%	1,864.54%
Retention Ratio	417	45.29%	103.68%	60.04%	-1,764.54%	100.00%
Div_1/P_0	417	2.40%	1.36%	2.29%	0.00%	13.60%
ROA	417	6.07%	5.17%	5.46%	-13.52%	32.07%
ROE	417	28.20%	122.02%	14.09%	-140.63%	2,287.26%
PEG Ratio	417	(3.26)	23.82	1.86	(97.38)	413.00
P/E (ttm) Explicit	417	24.16	29.02	20.06	0	441.38
P/E (ttm) Implied	417	19.83	45.31	19.93	(559.48)	440.00
g_1	417	6.92%	26.70%	8.47%	-483.20%	127.30%
g_2	408	12.10%	18.92%	10.01%	-30.30%	329.39%
g_3	408	9.66%	36.34%	10.05%	-553.94%	328.36%
g_4	417	12.68%	64.22%	8.00%	-210.44%	1,135.62%
g_5	417	2.96%	5.05%	2.67%	-54.35%	28.59%

Panel C. Non-Dividend Payers

	N	Mean	Std Dev	Median	Min	Max
Beta	86	1.58	2.87	1.08	(0.00)	23.83
ROA	86	6.87%	5.45%	6.16%	-10.08%	28.75%
ROE	86	8.37%	34.60%	13.93%	-142.07%	129.20%
PEG Ratio	86	(19.60)	202.50	1.37	(1,874.00)	76.14
P/E (ttm) Explicit	86	78.06	381.60	20.81	0	3,515.38
P/E (ttm) Implied	84	75.57	513.31	20.92	(1,102.14)	4,535.00
g_1	86	10.18%	16.65%	12.42%	-77.40%	49.83%
g_2	83	65.13%	409.19%	15.64%	-10.00%	3,739.77%
g_3	83	71.21%	531.17%	15.35%	-415.90%	4,824.47%
g_4	86	8.34%	34.60%	13.93%	-142.07%	129.20%
g_5	86	6.84%	5.47%	6.16%	-10.08%	28.75%

Table 2 - Implied Equity Risk Premiums

This table summarizes the mean market risk premiums (RMRF) implied by equating the CAPM of Sharpe (1964) and Lintner (1965) to the Gordon Growth Model [GGM] of Gordon and Shapiro (1956) with data taken from Yahoo! Finance on April 21, 2016. All S&P 500 stocks for which data exists are included.

Panel A. $g_1 \equiv$ Analyst 5-year Estimate

	Full Sample	Dividend Payers	Non-Dividend Payers
N	492	410	82
Mean RMRF	13.05%	12.47%	15.97%
Median RMRF	11.37%	11.26%	11.74%
Std. Dev.	39.78%	40.14%	38.03%

Panel B. $g_2 \equiv$ Explicit P/E ÷ PEG Ratio

	Full Sample	Dividend Payers	Non-Dividend Payers
N	483	402	81
Mean RMRF	25.16%	19.09%	55.27%
Median RMRF	12.99%	12.81%	15.24%
Std. Dev.	117.51%	26.13%	280.49%

Panel C. $g_3 \equiv$ Implied P/E ÷ PEG Ratio

	Full Sample	Dividend Payers	Non-Dividend Payers
N	483	402	81
Mean RMRF	23.19%	16.02%	58.77%
Median RMRF	12.98%	12.72%	14.98%
Std. Dev.	157.04%	53.75%	364.10%

Panel D. $g_4 \equiv$ ROE × Retention Ratio

	Full Sample	Dividend Payers	Non-Dividend Payers
N	492	410	82
Mean RMRF	15.60%	15.43%	16.43%
Median RMRF	10.60%	10.09%	11.65%
Std. Dev.	46.97%	47.83%	42.65%

Panel E. $g_5 \equiv$ ROA × Retention Ratio

	Full Sample	Dividend Payers	Non-Dividend Payers
N	492	410	82
Mean RMRF	7.07%	6.26%	11.11%
Median RMRF	4.98%	5.04%	4.66%
Std. Dev.	12.15%	9.19%	21.17%

Table 3 - Industry Risk Premia.

This table summarizes the mean market risk premiums (RMRF) for each of the 11 S&P Sectors used within the S&P 500 Index. These average premia are implied by equating the CAPM of Sharpe (1964) and Lintner (1965) to the Gordon Growth Model [GGM] of Gordon and Shapiro (1956) with data taken from Yahoo! Finance on April 21, 2016. All S&P 500 stocks for which data exists are included. When specifying a growth rate for the GGM, we use the following five measures: $g_1 \equiv$ Analyst 5-year Estimate, $g_2 \equiv$ Explicit P/E ÷ PEG Ratio, $g_3 \equiv$ Implied P/E ÷ PEG Ratio, $g_4 \equiv$ ROE × Retention Ratio, and $g_5 \equiv$ ROA × Retention Ratio.

	Mean RMRF Using g_1	Mean RMRF Using g_2	Mean RMRF Using g_3	Mean RMRF Using g_4	Mean RMRF Using g_5	Average
Communication Services	10.37%	16.58%	16.46%	13.48%	4.66%	12.31%
Consumer Discretionary	20.18%	23.00%	22.70%	21.36%	12.03%	19.86%
Consumer Staples	17.01%	19.17%	18.66%	47.40%	10.33%	22.51%
Energy	0.11%	9.30%	12.87%	(18.13%)	(2.14%)	0.42%
Financials	(0.12%)	13.33%	8.34%	10.43%	3.91%	7.16%
Health Care	16.61%	31.12%	13.94%	15.19%	7.78%	16.93%
Industrials	11.78%	14.22%	12.37%	23.58%	7.48%	13.89%
Information Technology	10.97%	56.24%	63.29%	14.49%	6.08%	30.22%
Materials	9.55%	14.30%	13.43%	10.23%	4.32%	10.36%
Real Estate	22.59%	41.73%	40.45%	(1.06%)	4.50%	21.64%
Utilities	32.71%	33.31%	33.67%	22.94%	15.50%	27.62%
S&P 500	13.05%	25.16%	23.19%	15.60%	7.07%	16.81%