Cost of Capital and ROE

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I. Introduction and Summary

Q. Please state your name, occupation and relationship with Portland General Electric ("PGE").

A. My name is Bente Villadsen and I am a principal at The Brattle Group (Brattle). My business address is The Brattle Group, 44 Brattle Street, Cambridge, MA 02138, USA. I have been asked by Portland General Electric (PGE) to estimate the cost of equity that PGE should be allowed an opportunity to earn on the equity portion of its rate base for the period after January 1, 2016.

My qualifications are included at the end of my testimony.

Q. Please summarize your results.

A. The estimates I rely on are detailed in Table 1 below.[1]

Table 1: Summary of ROE Estimates for PGE

	Range of Estimates
DCF models	9.8% - 11.2%
Risk Premium models	10.0% - 10.7%
Other Tests[2]	9.8% - 10.2%
Overall Range	9.8% - 11.2%
Point Estimate	10.25%

I understand that the Commission in the past has relied primarily on the Discounted Cash Flow (DCF) model and in particular the multi-stage DCF model, which I estimate at 10.0%

[1] The Oregon Public Utilities Commission has, in the past, given no weight to the CAPM (Order 01-777, p. 32). Therefore, I use the CAPM as a check on the other estimates rather than a primary method in this matter.
[2] I use the CAPM as a check, which results in an ROE of 9.8% to 10.2%. The average allowed ROE for integrated electric utilities in 2014 was 9.96%. See PGE Exhibits 1103 and 1105 for details.

using a combination of the Blue Chip and the Office of Management and Budget (OMB) long-term growth rate (and at 9.8% using Blue Chip alone). Thus, I find a range of 9.8% to 11.2% using the DCF and Risk premium models. This range includes PGE's requested ROE of 9.9%, while the Commission's preferred methods result in a higher ROE. My best point estimate is about 10.25%. I therefore find that PGE's request for 9.9% ROE on a capital structure with 50% equity is reasonable, consistent with my analysis, albeit conservative.

Q. How did you estimate the ROE for PGE?

A. To assess the cost of capital for PGE, I start by selecting a sample of integrated electric utilities from Value Line's universe of electric utilities. The sample companies are selected to be comparable to PGE, so I include electric utilities that (i) have more than 50% regulated assets and (ii) own generation. In addition, the companies are screened based on financial criteria such as credit ratings and on data availability. For each company, I then estimate the cost of equity using standard methods including two versions of the DCF model, three versions of the risk premium model, and as a test, two versions of the Capital Asset Pricing Model (CAPM). My results are checked against the recently allowed return on equity of other integrated electric utilities. I ensure consistency between the capital structure used to derive the cost of equity estimates and PGE's regulatory capital structure and also evaluate critical risk factors that may differ between PGE and the sample. Specifically, I note that PGE is smaller than the majority of the sample companies, currently has a larger amount of power purchase agreements although the magnitude will be reduced going forward, and needs to integrate substantial amounts of new generation (natural gas and wind) into its fleet.

I also note that the average credit rating in my sample is close to BBB+ using Standard & Poor's (S&P) ratings, while S&P rates PGE BBB (Moody's rates PGE higher at A3).[3]

[3] Ratings cited in my work papers are S&P ratings as reported by Bloomberg.

II. Cost of Capital Theory

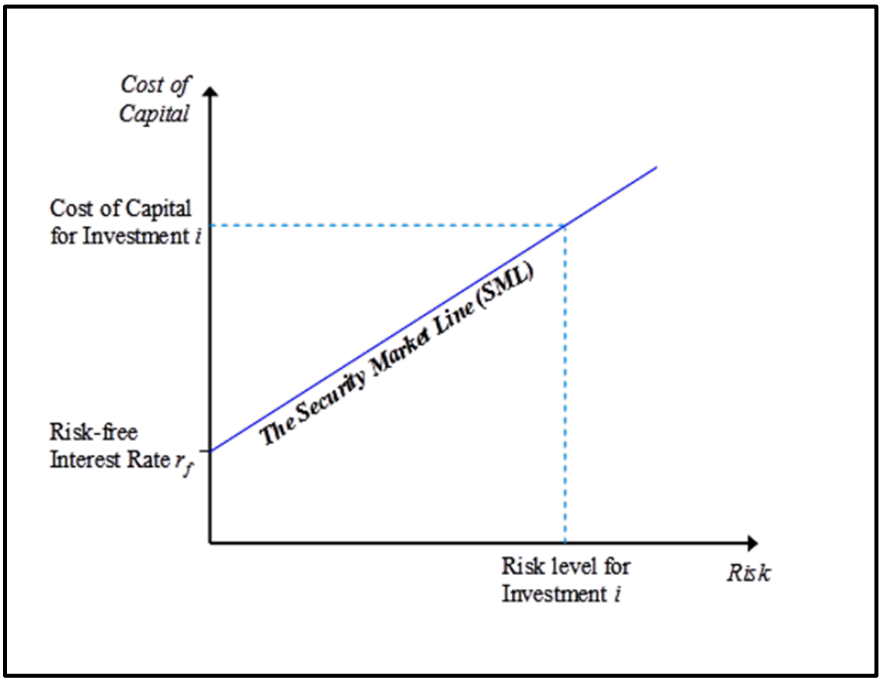
A. Cost of Capital and Risk

Q. How is the "cost of capital" defined?

A. The cost of capital is defined as the expected rate of return in capital markets on alternative investments of equivalent risk. In other words, it is the rate of return investors require based on the risk-return alternatives available in competitive capital markets. The cost of capital is a type of opportunity cost: it represents the rate of return that investors could expect to earn elsewhere without bearing more risk. "Expected" is used in the statistical sense: the mean of the distribution of possible outcomes. The terms "expect" and "expected," as in the definition of the cost of capital itself, refer to the probability-weighted average over all possible outcomes.

The definition of the cost of capital recognizes a tradeoff between risk and return that can be represented by the "security market risk-return line" or "Security Market Line" for short. This line is depicted in Figure 1 below. The higher the risk, the higher the cost of capital required.

Figure 1: The Security Market Line



Q. Why is the cost of capital relevant in rate regulation?

A. As noted above, the "cost of capital" is the return that investors expect to earn on investments of comparable risk[4] and is viewed as consistent with the U.S. Supreme Court's opinions in *Bluefield Water Works & Improvement Co. v. Public Service Commission of West Virginia*, 262 U.S. 679 (1923), and *Federal Power Commission v. Hope Natural Gas Co.*, 320 U.S. 591 (1944) as well as with Oregon law, ORS ¶756.040, which consistent with the Bluefield and Hope, holds that:

> Rates are fair and reasonable for the purposes of this subsection if the rates provide adequate revenue both for operating expenses of the public utility or telecommunications utility and for capital costs of the utility, with a return to the equity holder that is:
> (a) Commensurate with the return on investments in other enterprises having corresponding risks; and

[4] For the development of a formal link between the cost of capital as defined by financial economics and the expected rate of return for utilities, see Stewart C. Myers, "Application of Finance Theory to Public Utility Rate Cases," *Bell Journal of Economics & Management Science* 3:58-97 (1972).

(b) Sufficient to ensure confidence in the financial integrity of the utility, allowing the utility to maintain its credit and attract capital.[5]

From an economic perspective, rate levels that give investors a fair opportunity to earn the cost of capital are the lowest levels that compensate investors for the risks they bear. Over the long run, an expected return above the cost of capital makes customers over pay for service. Regulatory commissions normally try to prevent such outcomes unless there are offsetting benefits (e.g., from incentive regulation that reduces future costs). At the same time, an expected return below the cost of capital does a disservice not just to investors but, importantly, to customers as well. Such a return denies the company the ability to attract capital, to maintain its financial integrity, and to expect a return commensurate with that of other enterprises attended by corresponding risks and uncertainties.

More important for customers, however, are the broader economic consequences of providing an inadequate return to the company's investors. In the short run, deviations from the expected rate of return on the rate base from the cost of capital may seemingly create a "zero-sum game"— investors gain if customers are overcharged, and customers gain if investors are shortchanged. But in fact, in the short term, a return below the cost of capital may adversely affect the utility's ability to provide stable and favorable rates because some potential efficiency investments may be delayed and the company may be forced to file more frequent rate cases. Moreover, in the long run, inadequate returns are likely to cost customers—and society generally—far more than may be saved in the short run. Inadequate returns lead to inadequate investment, whether for maintenance or for new plant and

[5] 2013 ORS ¶ 756.040. Available at http://www.oregonlaws.org/ors/756.040.

equipment. Without access to investor capital, the company may be forced to forgo opportunities to maintain, upgrade, and expand its systems and facilities in ways that decrease long run costs. Indeed, the cost to consumers of an undercapitalized industry can be far greater than any short-run gains from shortfalls in the cost of capital. This is especially true in capital-intensive industries (such as the electric utility industry), which feature systems that take a long time to decay. Such long-lived infrastructure assets cannot be repaired or replaced overnight, because of the time necessary to plan and construct the facilities. Thus, it is in customers' interest not only to make sure the return investors expect does not exceed the cost of capital, but also to make sure that the return does not fall short of the cost of capital.

The cost of capital cannot be estimated with perfect certainty, and other aspects of the way the revenue requirement is set may mean investors expect to earn more or less than the cost of capital, even if the allowed rate of return exactly equals the cost of capital.

B. The Impact of Risk on the Cost of Capital

Q. Please summarize how you consider risk when estimating the cost of capital.

A. First, I select my comparable sample to have as comparable business risks as possible to PGE. Second, as the cost of equity depends on the leverage of the company to which it is applied, I consider the difference in leverage between the data from which I estimate the cost of equity and PGE. Third, I consider any PGE-specific risk that may help me place the Company within the range of my estimated cost of equity or if unique circumstances dictate it, above or below the range.

Q. Why is capital structure important for the determination of the cost of equity for PGE?

A. As shown by Hamada (1979),[6] shareholders in a company with more debt face more equity risk and the return on equity needs to increase. Commission Staff has in past proceedings acknowledged this principle. [7] One way to take the phenomena into account is to determine the after-tax weighted-average cost of capital for the entities and ensure that figure stays constant between the estimate obtained for the sample and the entity to which it is applied.

Q. Please explain how you calculate and implement the methodology.

A. The after-tax weighted average cost of capital (ATWACC) is calculated as the weighted average of the after-tax cost of debt capital and the cost of equity. Specifically, the following equation pertains:[8]

$$ATWACC = r_D \times (1 - T_C) \times \%\ D + r_E \times \%\ E \qquad (1)$$

where r_D = market cost of debt,

r_E = market cost of equity,

T_C = corporate income tax rate,

$\%D$ = % debt in the capital structure, and

$\%E$ = % equity in the capital structure

The ATWACC is commonly referred to as the WACC in financial textbooks and is used in investment decisions.[9] The return on equity consistent with the sample's overall cost of capital estimate, the market cost of debt, the corporate income tax rate, and the amount of debt and common equity in the capital structure can be determined by solving equation (1) for r_E . Having determined the after-tax weighted-average cost of capital for the

[6] Robert S. Hamada, "Portfolio Analysis, Market Equilibrium and Corporate Finance," *The Journal of Finance* 24: 13-31 (March 1969).
[7] See, for example, UE 283 Exhibit 200, p. 8.
[8] The equation is shown with only debt and common equity. If the capital structure has preferred equity, add the following term ($r_P \times \%\ P$) to the right-hand side of the equation.
[9] See, for example, Brealey, Myers and Allen (2013), *Principles of Corporate Finance, 11th Edition*, p. 221.

sample companies, I can determine what ROE I need to ensure the same after-tax weighted-average cost of capital is applied to PGE.[10]

Q. Why is this relevant to this proceeding?

A. The ATWACC is one of several procedures in my analysis; it is important because it allows a comparison between the sample companies' costs of capital estimates that are based on market data and the cost of capital for PGE, which is based on book value figures. Two otherwise identical companies with different capital structures will typically have different costs of equity because the risks to equity holders depend on financial leverage (i.e., the amount of debt in the capital structure of the company). This makes it difficult to compare cost-of-equity estimates among companies that have different capital structures. The effect of varying financial leverage on the risk-return tradeoffs of companies means that simply averaging individual cost-of-equity estimates across a sample generally does not provide meaningful information about an appropriate representative cost of capital for the industry. Thus, if the capital structure used to estimate the benchmark sample's cost of equity differs from the capital structure used to regulate PGE, it is necessary to consider the leverage impact.

Q. Does this approach apply to the risk premium analysis?

A. Yes, to the extent that there are differences between the capital structures of the companies used to determine the benchmark ROE and PGE, I need to consider whether I am comparing apples to apples. However, because both earned and allowed ROE are applied to book value

[10] I refer to the ATWACC to distinguish it from the WACC used in regulatory proceedings which is the weighted-average of the after-tax cost of equity and the *pre-tax* cost of debt instead of the after-tax cost of debt.

capital structures, it is the book value capital structure that is relevant in the risk premium methods.

Q. What is the basis for the development of the method?

A. The weighted-average cost of capital – as it is called in textbooks—is the fundamental method used by financial economists to measure the cost of capital. It is a standard topic taught in graduate level courses in corporate finance and is based upon the work of Professors Franco Modigliani and Merton Miller. Each separately won the Nobel Prize in Economics, in part, for developing the theories underlying the method. It is critical to keep in mind that the weighted average cost of capital method is one useful tool to assist in the analysis of the cost of capital. All cost of capital witnesses estimate the cost of equity using the DCF, risk premium, CAPM, and other models, and all must interpret the results relative to the risk of the regulated company at issue. The purpose of the method is to allow an "apples to apples" comparison of the results of the sample companies by adjusting for differences in financial risk due to differences in capital structure. The ATWACC is sometimes mischaracterized in regulatory proceedings and incorrectly criticized, possibly because the critics do not like the method's results, but it is the standard methodology in finance. It is consistent with the use of rate base measured on the basis of book value, and does not require a regulator to "rubber stamp" the current market value of the regulated company's stock as is sometimes asserted.

Q. Are there other PGE-specific risk factors?

A. Yes, the majority of the publicly traded electric utilities in the U.S. as well as the companies, I select for my sample, are larger than PGE. For example, the market capitalization for more than half of my sample companies is above $5 billion and categorized as large cap

companies. In contrast, PGE has a market capitalization of only $2.6 billion and this is at the low end of the mid-cap companies.[11]

Q. Why does the size of PGE matter?

A. Empirically, investors have required a higher premium to invest in smaller companies than in larger ones. For example, Morningstar / Ibbotson data indicate that mid-cap companies ($2 - $5 billion in market capitalization) on average have a return on equity that is 1.14% higher than that of large-cap companies.[12] Therefore, empirical evidence suggests that investors in smaller and mid-cap companies require a higher return than do investors in larger companies. The majority of electric utilities (including my sample companies) are materially larger than PGE. Only four companies have a market cap below that of PGE, while 19 companies have a market cap that is more than twice that of PGE.[13] Thus, empirical evidence suggests that investors in PGE require a premium over and above that required for larger companies. Because the sample consists of both smaller and larger companies, the premium necessarily needs to be somewhere below 1.14% but not zero as the selection of larger companies downward biases the cost of equity estimate.

Q. What other risks create a higher overall risk for PGE?

A. There are several reasons why PGE has a higher level of risk than the comparable companies. It is important to recognize the relative risk of the targeted entity, PGE, versus that of the sample companies used to determine the ROE. Because PGE is substantially

[11] Value Line Investment Survey, as of 1/7/2015 list Allete, Cleco, IDACORP, and Westar as mid- cap companies, while AEP, DTE, Edison International and PG&E are listed as large cap. Value Line defines mid-cap companies as having a market capitalization between $1 and $5 billion, and large companies as having market values greater than $5 billion.
[12] Morningstar / Ibbotson, *SBBI 2014 Classic Yearbook*, p. 109.
[13] See Table 2 below.

smaller than the average proxy company, continues to integrate a large amount of new generation in its generation mix, and is viewed by Value Line as having a slightly higher relative risk (beta) than the sample, the company faces larger risks than the average proxy company. As such it should be placed above the midpoint for the proxy group. As noted above, Ibbotson finds that the required return for an entity in the mid-cap range is approximately 1.14% and the need to integrate generation, and its lower S&P credit rating, increases the cost of capital.

Q. What conclusions do you draw from the discussion above?

A. Because there is a link between capital structure[14] and the size premium[15] I formally adjust for the leverage, but do not adjust for the size albeit PGE should be placed at or above the midpoint for the sample.

[14] For example, K.C. Chan and N.-F. Chen, "Structural and Return Characteristics of Small and Larger Firms," *The Journal of Finance* 46, 1992, pp. 1467-1484 or Brealey, Myers, and Allen, "*Principles of Corporate Finance*." 11th edition, 2014, pp. 436 – 437.
[15] Morningstar / Ibbotson, *SBBI 2014 Classic Yearbook*, p. 109.

III. Impact of the Economy and Markets on the Cost of Capital

Q. What do you cover in this section?

A. This section addresses the effect of the current economic situation and financial market conditions on the cost of capital. Specifically, this section addresses (i) how monetary policy has driven interest rates to historic lows and the plausible impact of a tapering of the policy on interest rates, (ii) the very large federal budget deficit and the potential impact on interest rates and inflation on a reduction in this deficit, and (iii) other factors that indicate how the current state of the economy and the industry impacts the cost of capital .and the access to capital.

Q. Please summarize your view on interest rate developments.

A. The Federal Reserve (Fed) has been completing its tapering of its asset purchasing program. While, the Fed purchases $75 billion worth of financial assets per month in January of 2014,[16] the figure was reduced to zero by the end of October 2014.[17] Although the Fed has finished its ongoing purchases, it must reduce its inventory of Treasury bonds and agency mortgage backed securities, which it accumulated in an effort to stimulate capital markets and keep interest rates low. The Fed's inventory of bonds increased from less than $869 billion in August 2007 to over $4 trillion at the end of 2013.[18] Unwinding this position will be a gradual process, and substantial effects of the taper on capital markets and interest rates

[16] Federal Reserve Bank of New York, "Statement Regarding Purchases of Treasury Securities and Agency Mortgage-Backed Securities," December 18, 2013.
[17] Federal Reserve Bank of New York. "Statement Regarding Purchases of Treasury Securities and Agency Mortgage-Backed Securities." October 29, 2014.
[18] *Bloomberg News*, "Fed Assets Reach Record $4 Trillion on Unprecedented Bond Buying," by Jeff Kearns, December 19, 2013. Available at:
http://www.bloomberg.com/news/articles/2013-12-19/fed-assets-reach-record-4-trillion-on-unprecedented-bond-buying

will not materialize overnight. However, it will eventually impact both access to capital and the cost. Furthermore, budget deficits at all levels of government are at high and unsustainable levels, and the potential exists for higher inflation as a result of deficit spending by the U.S. government and further liquidity injected into the capital markets by the Fed.

Q. What was the purpose of the Fed's asset purchases?

A. The Fed purchased bonds and other financial assets to stimulate the economy, reassure the capital markets, and keep interest rates low. The primary purpose of the asset purchase program was to drive down long-term interest rates, and in this regard it has been remarkably successful. The effectiveness of this policy is evidenced by the fact that U.S. Treasury Bond yields remain low by historical standards. Long-term and short-term interest rates were driven to historic lows[19] before beginning to increase with the start of tapering. The goal of the program was to spur economic activity by making it cheaper to borrow funds for new investment or to purchase durable assets such as houses and automobiles.

Q. What effects did the Fed's purchases have on equity and other markets?

A. During the crisis and its aftermath, the Fed's purchases supported the stock market by depressing the expected returns to bond investors. In times of economic uncertainty (such as the financial crisis), investors seek to reduce their exposure to market risk. This precipitates a so-called "flight to safety," wherein demand for low-risk government bonds rises at the expense of demand for stocks. If yields on bonds are extraordinarily low, however, any investor seeking a higher expected return must choose alternative investments such as

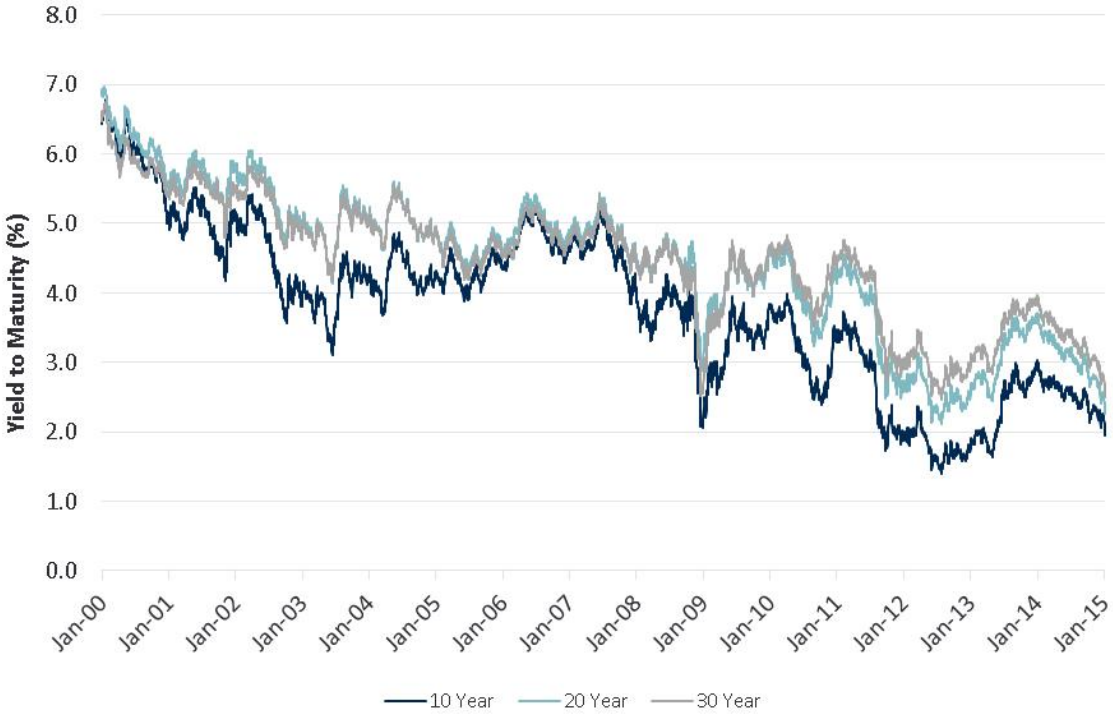
[19] See for example, the "long term stock, bond, interest rate and consumption data" provided at Professor Robert Shiller's website: http://www.econ.yale.edu/~shiller/data.htm

stocks, real estate, or gold or collectibles. Of course, all of these investments are riskier than government bonds, and investors still demand a risk premium (perhaps an especially high one in times of economic uncertainty) for investing in them. But short of accepting meager returns, investors simply have few alternatives to returning to the stock market. Thus, the Fed's bond purchases somewhat mitigate the effect of the "flight to safety" on equities and other investments. Utility stocks in particular benefit from this phenomenon because of their dividends. Emerging market countries benefited too, as investors sought higher returns.

Q. What has been the effect of the tapering during 2014?

A. Interest rates have increased since the possibility of tapering was first discussed in June 2013. (See Figure 2), but during 2014 and very early 2015, interest rates have declined slowly. Thus, while government bond yields have recovered somewhat from their historical lows in 2012 and early 2013, long-term U.S. treasury yields remain well below their pre-crisis and long-term average levels.

Figure 2: US Treasury Bond Yields from January 2000 – December 2014



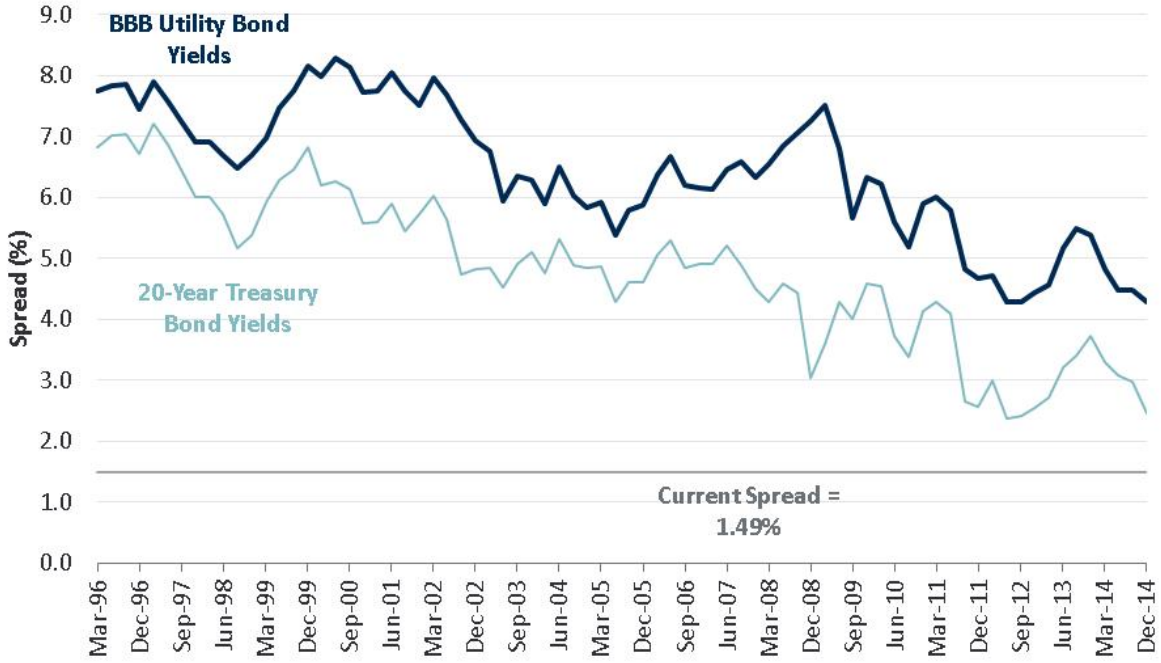
Source: Bloomberg as of January 7, 2014

Investor uncertainty is illustrated by the flow of funds into and out of mutual funds. (See Figures 5 and 6 below) Transfers out of bond mutual funds spiked when the Fed first discussed tapering, and stayed high through the end of 2013. This was likely driven by investors' expectations of rising interest rates, which would lead to falling bond prices. However, 2014 saw positive and increasing net flows into bond funds, reflecting a shift in expectations about interest rates: market participants are less convinced that rates will rise in the near term. Flows into equity mutual funds, meanwhile, have been somewhat erratic, with recent outflows suggesting that mutual fund investors may not have fully regained their appetite for risky stock investments.

Q. Has the yield spread between government and utility bonds changed since the start of the credit crisis?

A. Yes. Although the yield on utility bonds had declined somewhat from the height of the crisis (and has decreased since the start of the taper), it has been higher during most of the past two years than it was prior to the credit crisis. As shown in Figure 3 below, since the last major peak in November 2008 the spread between the yield on BBB-rated 20-year utility bonds and the yield on 20-year government bonds has ranged from a low of 133 basis points to a high of 418 basis points, compared to a 10-year historical average of approximately 150 basis points at that time.

Figure 3: Spread Between BBB Utility Bonds and 20-Year U.S. Treasury Bond Yields, January 1996 – December 2014



Source: Bloomberg as of January 7, 2014

Q. What is the implication of higher than normal yield spreads?

A. A higher than normal yield spread is one indication of the higher risk premium prevailing in the capital markets. Investors consider a risk-return tradeoff (like the one displayed in

Figure 1 above) and select investments based upon the desired level of risk. Higher yield spreads reflect the fact that the return on corporate debt is higher relative to government bond yields than is normally the case, even for regulated utilities. Because debt is less risky than equity, this means that the cost of equity must also be higher relative to government bond yields than is usually observed. If this fact is not recognized, then the traditional cost of capital estimation models will underestimate the cost of capital prevailing in the capital markets.

Q. Are the higher than normal yield spreads an indication of investors' "flight to safety"?

A. Yes. When investors become concerned about the economy, they frequently seek to reduce their exposure to investment risk. U.S. government debt is generally considered the least risky available investment—in effect it is regarded as the closest thing to a risk-free asset. Thus, U.S. government debt is in high demand during times of economic and political uncertainty. This implies in turn that the yields on U.S. government bonds are likely to be relatively lower during periods of economic and political turmoil. Moreover, the U.S. Fed's continued bond purchase programs have further increased the demand for medium- and long-term U.S. government bonds, thus depressing the yields on those bonds.

Q. What evidence can you provide that U.S. medium- and long-term government bond yields are currently depressed?

A. Over the past few years, the annual yields on long-term U.S. government bonds have dropped dramatically and remain depressed. For instance, the historical average of annual yields on long-term government bonds was 5.15% from 1926 through 2013, but long-term (20-year) government bond yields averaged 3.62% in 2011, 2.54% in 2012, 3.12% in 2013,

and 3.07% 2014.[20] The slowing pace of the Fed's bond purchases and the recent outflows from bond funds has translated into a modest increase in bond yields but still well below the 15-year historical average of about 4.5%.[21]

Blue Chip Economic Indicators dated October 10, 2014 reports the consensus economic projections for the yield on 10-year U.S. Treasury notes to be 3.8% in 2016 and 4.2% in 2017. These consensus forecasts suggest that 10-year Treasury note yields will trend upward to 4.3% on average for 2016-2020 and 4.5% on average for 2021-2025.[22] These forecasts are substantially higher than the recent 2.1 – 2.4% yield on 10-year U.S. government bonds,[23] and highlight the fact that current long-term government bond yields are low both relative to historical levels, as well as compared to consensus forecasts of future rates. The currently depressed level of long-term government bond yields must be considered when evaluating the results of the risk-positioning model, because the downward bias in the long-term risk-free interest rate will inappropriately lower the sample companies' ROE estimates that would result, for example, from mechanically calculating the CAPM using current yields.

Q. Do regulated companies benefit from investors' flight to safety?

A. Yes, to some degree. Regulated companies are of lower relative risk than the average company in the market, and so investors may prefer to invest in them rather than in riskier companies during bad times. However, regardless of the type of investment, the required equity return is higher during periods of economic turmoil than otherwise because corporate and (especially) "risk free" government bonds are much less risky than equity, including

[20] Bloomberg daily data for the 20-year government bond yield.
[21] *Ibid*. using data from 2000 to today.
[22] See *Blue Chip Economic Indicators*, dated October 10, 2014, page 14.
[23] As of December 9, 2014.

utilities. This was demonstrated during the recent turmoil: prices of regulated companies fell along with the broader market. However, they did not fall as far (in percentage terms) as the market; this is as expected because regulated companies have lower risk than the market as a whole. Risk-positioning models predict that companies with lower betas, i.e., companies with lower risk relative to the market, will move with the market, but with lower volatility. The prices of regulated companies recovered faster than the market, in part because of the flight to safety, but have now been surpassed by the general market, again as expected according to the predictions of risk-positioning models.

Q. Why is it important to consider the stock market's volatility?

A. Academic research has found that investors expect a higher risk premium during more volatile periods. The higher the risk premium, the higher the required return on equity. For example, French, Schwert, and Stambaugh (1987) found a positive relationship between the expected market risk premium ("MRP") and volatility:

> We find evidence that the expected market risk premium (the expected return on a stock portfolio minus the Treasury bill yield) is positively related to the predictable volatility of stock returns. There is also evidence that unexpected stock returns are negatively related to the unexpected change in the volatility of stock returns. This negative relation provides indirect evidence of a positive relation between expected risk premiums and volatility.[24]

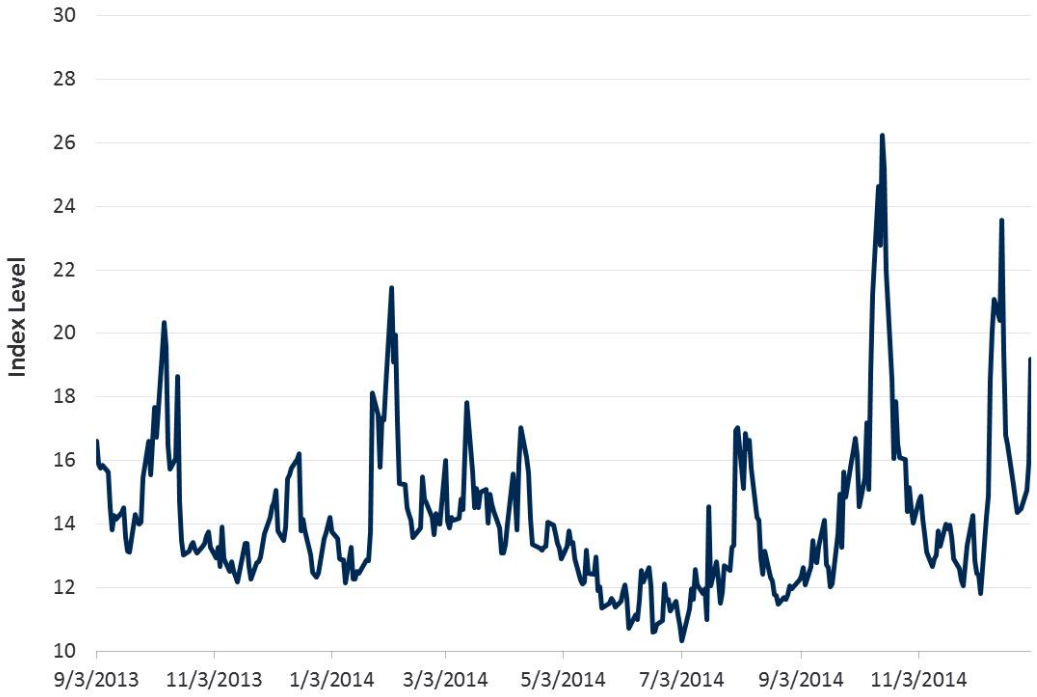
One implication of this finding is that the MRP tends to increase when market volatility is high, even when investors' level of risk aversion remains unchanged. Recently, market expectations for the volatility of the S&P 500 index have been quite close to their long-term average of approximately 20%.[25] However, as seen in Figure 4 below, the variability in

[24] K. French, W. Schwert and R. Stambaugh (1987), "Expected Stock Returns and Volatility," *Journal of Financial Economics*, Vol. 19, p. 3.

[25] As measured by the CBOE Volatility Index (VIX), which measures market expectations for (annualized) 30-day volatility of the S&P 500 stock index based on implied volatility of options on the S&P 500. The average closing

monthly stock market volatility has itself been quite high over the past year, with occasional spikes, indicating periods of increased uncertainty about likely market outcomes. For example, the Chicago Board Option Exchange Volatility Index (VIX) most recently increased above 25% on December 16, 2014 as both the Dow Jones and S&P 500 dropped more than 4%, oil prices declined, and the Russian currency declined relative to the U.S. dollar.[26]

Figure 4: VIX 09/2013-12/2014



Source: Bloomberg as of 1/5/2015

Q. What do you mean by the term "risk aversion"?

A. Risk aversion is the recognition that investors dislike risk, which means that for any given level of risk, investors must expect to earn an appropriate return to be induced to invest. An

index value for the VIX from January 1, 2004 to December 31, 2014 was 19.62. Data pulled from Bloomberg as of 1/5/2015.

[26] YahooFinance.com; http://peterckenny.tumblr.com/post/105352024749/russian-ruble-collapse-fueled-by-global-petroleum.

increase in risk aversion means that investors now require a higher return for that same level of risk.

Q. Do you have any evidence that the return premium demanded by investors for taking risk is higher than it was prior to the crisis?

A. Yes. In response to the crisis, investors began allocating much larger shares of their portfolios to lower risk investments. In fact, many investors have left their investments in cash or low-yielding Treasuries rather than investing in stocks. For example, Figure 5 below compares monthly net new mutual fund flows into U.S. domestic equities versus total net flows into bonds. Figure 5 shows that net cash flows into domestic equities were predominantly negative from mid-2010 through the end of 2012, reaching almost $30 billion in outflows in July 2011. On the other hand, net flows into bonds were consistently positive throughout the crisis and its aftermath, with monthly inflows reaching nearly $35 billion at several points in 2012 and early 2013.

As discussed above, the latter trend reversed sharply in the second half of 2013—likely in response to the Fed's announcement in June 2013 regarding the tapering of its quantitative easing program.[27] This announcement led to a dramatic global bond sell-off, headlined by $60 billion in outflows from U.S. bond mutual funds as of June 2013.[28] Through the latter half of 2013, bond yields climbed as demand for bonds dipped,[29] reflecting expectations that interest rates would finally rise after remaining so low for so long.

[27] "Fed message gets through to markets, sort of", Alister Bull, July 16, 2013, *Reuters*.
[28] *Ibid.*

[29] Bond yields rise when prices fall, since face value and coupon payments are fixed.

At the start of 2014, many traders held short positions in U.S. Treasury bonds—effectively betting that government bond prices would fall as the interest rates rose in response to a growing economy. However, these expectations failed to materialize. Instead, the first eight months of 2014 saw a rally in bond buying (see Figure 2). By the end of December, Treasury yields were trading at their lowest levels since before the Fed's June 2013 tapering announcement.[30] This bond rally has surprised many market observers since U.S. economic indicators have shown modest improvement and most forecasters continue to expect higher interest rates in the medium term.[31] Nevertheless, investors who bet against bonds at the end of 2013 moved back into safe debt investments when predicted interest rate rises failed to materialize.

Additionally, U.S. Treasury bonds are especially appealing in 2014 when compared to European sovereign debt, for which yields are being driven down by slow economic growth and resulting monetary stimulus from the European Central Bank ("ECB") and more recently by the fear for another crisis in Greece. In June of 2014, the ECB made history by establishing a negative bank deposit rate — effectively charging banks money for depositing their money in the central bank.[32] Previously, banks were earning some, albeit small, interest on their funds kept at the central bank account. This accommodative stance by the ECB reflects a low interest rate outlook for European markets, perhaps driving bond investors to seek potential upside in the U.S. debt market.

[30] Bloomberg LP, 10-Year, 20-Year and 30-Year U.S. Treasury bond Yields, accessed September 16, 2014.
[31] See, for example, Consensus Forecasts® September, 2014 survey, which predicts 10-Year Treasury bond yields will increase from 2.5% as of the survey to 3.4% by the end of September 2015.
[32] "ECB Unveils Rate Cuts, Lending Package", June 5, 2014, *The Wall Street Journal.* Available at:
http://www.wsj.com/articles/ecb-enters-uncharted-territory-with-rate-cuts-1401969463

The U.S. stock market has generally performed well in 2013 and 2014, but the second half of 2014 saw significant ups and down and the net flows for U.S. equity mutual funds have not exhibited a consistent trend. Although the uniform outflows observed in the early part of this decade have not occurred in the last couple of years, there is no clear indication in the data that investors are ready to move their money back into equities; i.e., a significant amount of investor funds are still placed in the bond market. Indeed, the short term trend of increasing outflows observed in the summer of 2014 (see Figure 5 and Figure 6 below)—together with the increased demand for bonds—suggests that a clear preference for lower-risk assets currently prevails in financial markets.

In general, these trends are consistent with the observation that the average investor's risk aversion remains elevated. Additionally, the particular set of circumstances leading to the current low bond yields may be a short-term phenomenon, suggesting that current yields may underestimate the long-term risk-free interest rate. As discussed in greater detail in below and in PGE Exhibit 1103, a higher-than-normal equity risk premium and an underestimated risk-free rate may lead to a downward bias in cost of capital estimates that use the CAPM based or similar methods.

Figure 5: US Domestic Equities vs. Bonds 2007-2014.

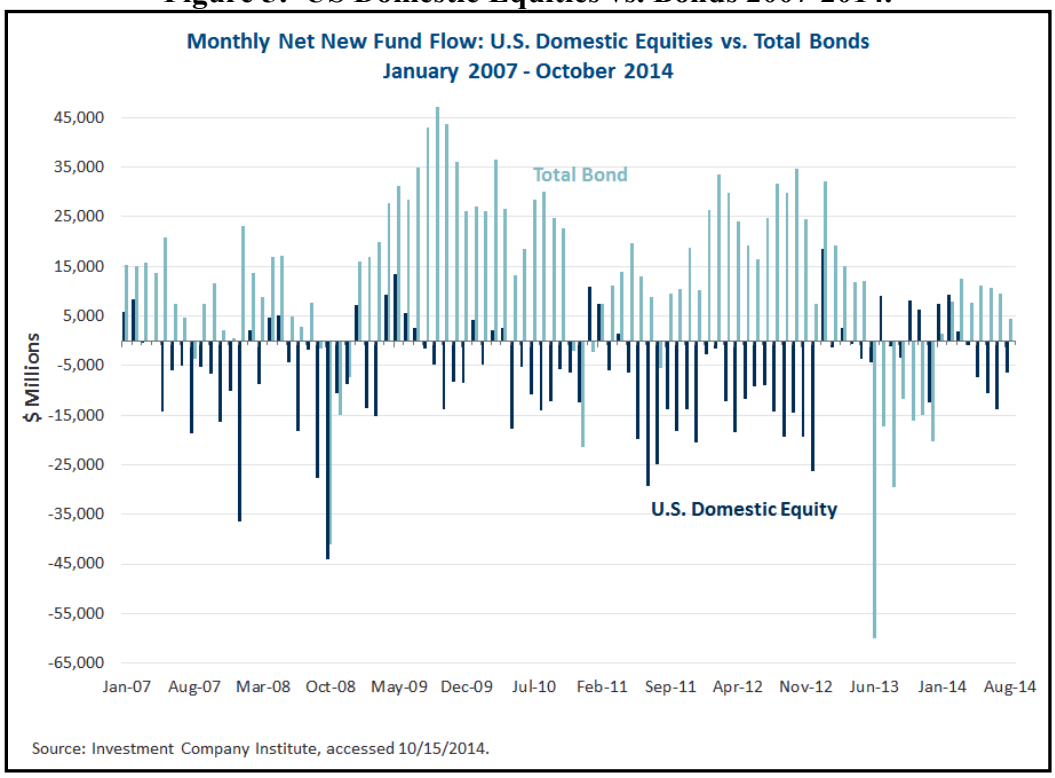
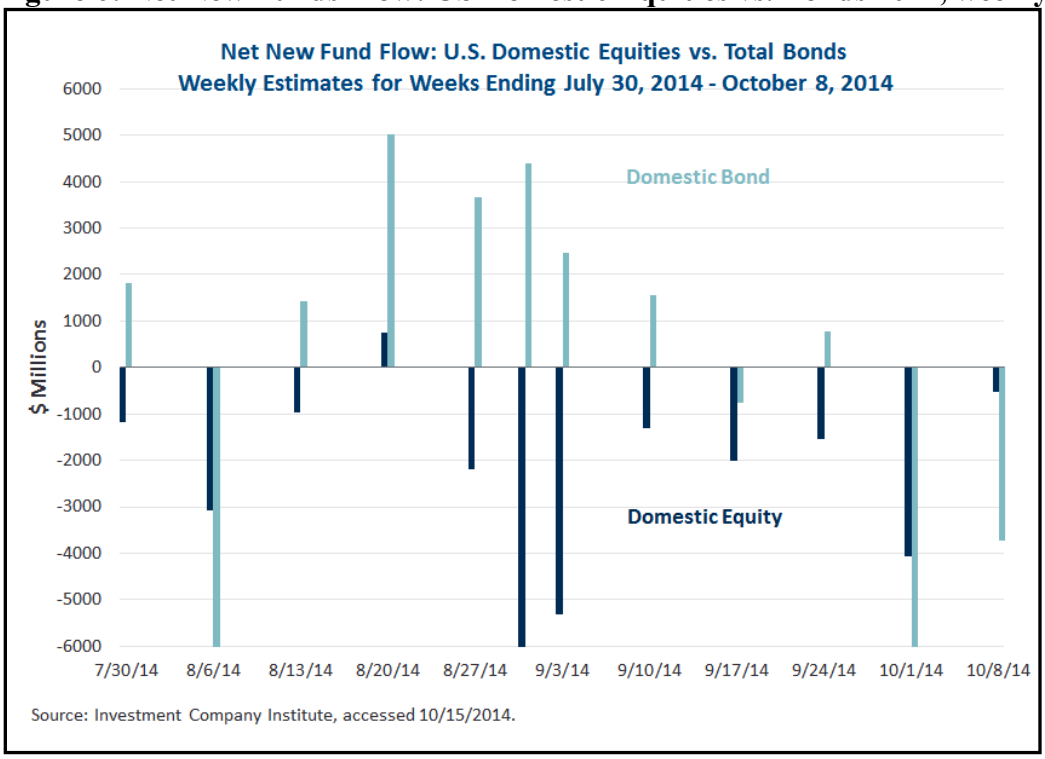


Figure 6: Net New Funds Flow: US Domestic Equities vs. Bonds 2014, weekly



Q. Is the increase in the market risk premium a short-term or a long-term phenomenon?

A. I believe that it is a long-term phenomenon. Even when market conditions return to normal, investors' risk aversion is likely to remain higher until their confidence fully returns, which is likely to be well into the recovery period. A recent paper by Duarte and Rosa of the Federal Reserve of New York summarizes many forward-looking models of the required MRP and finds (illustrates) a very high MRP in recent years.

The authors estimate the MRP that results from a range of models each year from 1960 through 2013.[33] The authors then report the average as well as the 25- and 75-percentile of results. The authors find that the models used to determine the risk premium are converging to provide more comparable estimates and that the average annual estimate of the MRP was at an all-time high in 2013.[34] Similarly, Bloomberg estimates a higher than historical MRP in recent years – again indicating that it could be a while before investors' required premium returns to normal levels.

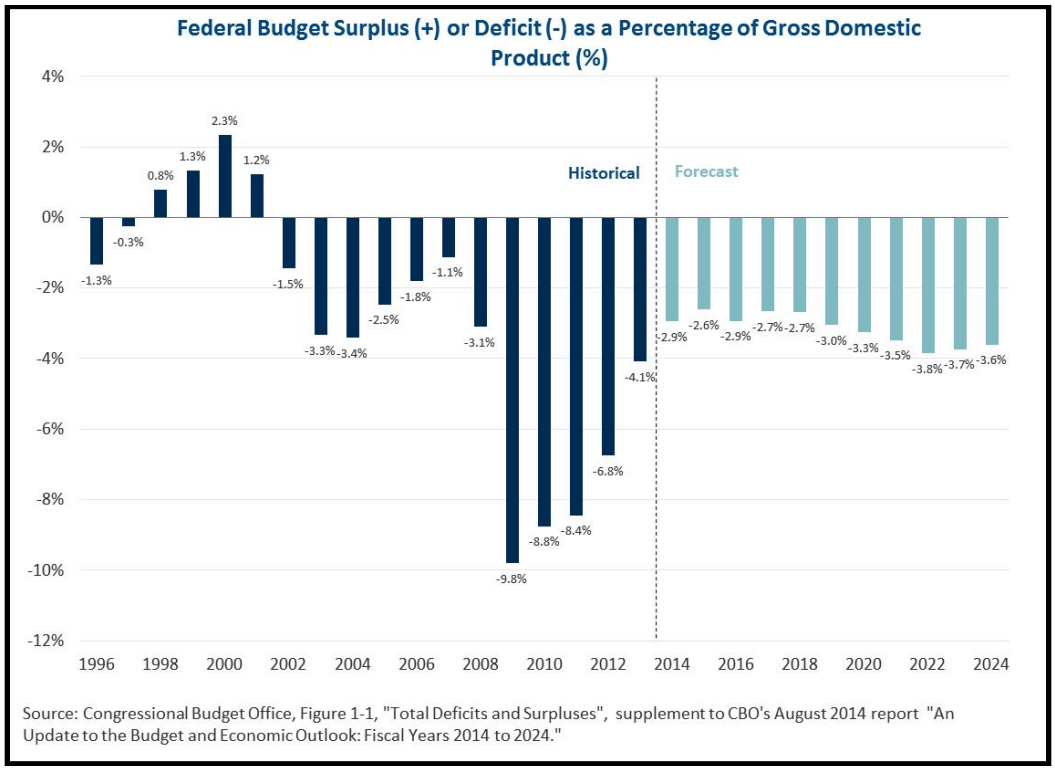
Q. What are your thoughts on the possible effect of the budget deficit on the economy?

A. In dollar terms, the federal budget deficit was $483 billion in fiscal year 2014 and $680 billion in 2013, down substantially from more than $1 trillion in fiscal year 2012.[35] This improvement may result partially from the budget sequestration that went into effect in early 2013. However, the 2013 fiscal year deficit was still approximately 50% higher than that of 2008 and well above the average level in the years leading up to the crisis. The U.S. Congressional Budget Office estimates that the budget deficit will represent approximately

[33] Fernando Duarte and Carlo Rosa, "The Equity Risk Premium: A Consensus of Models*," Federal Reserve Bank of New York*, 2014 (Duarte & Rosa 2014).
[34] Technically, Figure 1 from Duarte & Rosa plots the "first principal component" of the 20 models. This means that the authors used statistics to compute a weighted average that captures the most variability among the 20 models over time.
[35] Federal Reserve Bank of St. Louis, Economic Data, "Federal Surplus or Deficit," January 8, 2015.

3% of the Gross Domestic Product (GDP) in 2014 and will remain high relative to economic output over the foreseeable future (see Figure 7 below).[36]

Figure 7: Federal Budget Surplus or Deficit as a Percentage of Gross Domestic Product



Maintaining such a high deficit is unsustainable in the long run, especially if buyers of U.S. debt lose confidence in the U.S. economy and demand higher interest rates as compensation for the perceived higher risk. This suggests that going forward, the U.S. will have to be more fiscally conservative, and limit the stimulus funds it provides to the economy. Although inflation is not currently an issue, it is also quite likely that the magnitude of the federal budget deficit will affect U.S. inflation going forward. The Fed

[36] Congressional Budget Office: http://www.cbo.gov/.

now holds approximately $1,706 billion in mortgage-backed securities.[37] It is unclear how the unwinding of these positions will affect financial markets, which creates additional uncertainty.

Q. Are there other factors that recently have affected capital markets?

A. Yes. During the most recent 6-7 months, oil prices have declines substantially and the volatility inherent in these prices has increased drastically. While it is too early to determine the impact on the economy in general, it adds uncertainty to a key commodity and hence investor expectations.[38] The decline in oil prices, sanctions or and factors have significantly impacted the Russian economy, so that S&P on January 26, 2015 downgraded Russia's foreign currency rating to junk.[39] In 1998, when Russia last saw a substantial crisis, the Dow Jones Industrial index plunges 512 points in one day and ultimately Long-Term Capital defaulted causing the eventual bail out of the bank of about $3.6 billion.[40]

Further, several developments in Europe add to the economic uncertainty for investors. First, the Swiss National Bank has recently removed the cap of the Swiss franc against the Euro causing some trading firms significant losses and other non-Euro currencies are under significant pressure.[41] Also, the recent general election in Greece has caused some uncertainty regarding the future of the Euro and the status of loans granted to Greece.

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[37] Federal Reserve Statistical Release as of September 25, 2014, available at http://www.federalreserve.gov/releases/h41/.
[38] PGE Exhibit 1107 shows the recent development in oil prices as well as the increase in the volatility inherent in oil prices. The volatility has more than doubled since the beginning of 2014.
[39] S&P, "Russia Foreign Currency Ratings Lowered to 'BB+/B'; Outlook Negative," January 26, 2015.
[40] William Watts, "This Russian crisis revives painful memories of 1998," Dec. 16, 2014 and CNN, "Dow Plunges 512 Points," August 31, 1998.
[41] For example, as of January 27, 2015 the interest rate on holding Danish kroner is negative at both State Street and Bank of New York Mellon. The Danish krone currently is pegged to the Euro. See, for example, http://www.slate.com/blogs/moneybox/2012/10/09/negative_interest_rates_for_swiss_francs_and_danish_krone_state_street_and_bank_of_new_york_mellon_go_less_than_zero_.html

Q. Please summarize how the economic developments discussed above have affected the return on equity and debt that investors require?

A. Companies such as PGE rely on investors in capital markets to support efficient business operations. These investors have been dramatically affected by the credit crisis, and while there have been material improvements in capital markets and the macro-economy since the height of the financial crisis, there is evidence that investors' confidence remains low and their risk aversion remains elevated relative to pre-crisis periods.

Likewise, the effects of the federal budget deficit and the Fed's unwinding of its involvement in providing credit may have substantial but uncertain effects on the economy and financial markets. Finally, due to increased risk-aversion on the part of investors, as well as continued bond-purchase programs initiated by the Fed, long-term U.S. government bond yields (along with forecasts of future interest rates) have been pushed down to extremely low levels by historical standards. As a result, yield spreads on utility debt, including top-rated instruments, have remained elevated. The evidence presented above demonstrates that the equity risk premium is higher today than it was prior to the crisis for all risky investments. This is true even for investments of lower-than-average risk, such as the equity of regulated utilities.

Q. Does your analysis consider the current economic conditions?

A. Yes. In implementing the CAPM and risk premium models, I rely on the estimated risk-free rate for the period when rates will be in effect rather than on the current risk-free rate. Further, the CAPM versions are based on the historical arithmetic MRP of 6.96%, whereas I in the past have relied on a range of figures below and above the historical estimate. The financial crisis and the current academic research have led me to believe that today's MRP

cannot be less than the historical MRP. For simplicity and because the CAPM is not commonly used to determine the ROE before this Commission, I currently use only the historical arithmetic average as reported by Morningstar / Ibbotson. In addition, I present evidence on the forward looking MRP to ensure my estimate is consistent with investors' current view.

IV. Estimating the Cost of Capital

A. Approach

Q. Please explain the process you used to estimate the cost of equity capital?

A. First, I select a sample of electric utilities, whose characteristics resemble those of PGE. Second, I estimate the cost of equity for the sample using several estimation methods to ensure that my measure reasonably reflects investor expectations. Third, I assess PGE's specific risks to determine a reasonable range given the company's specific characteristics. Finally, I check my recommendation against other measures such as the allowed return on equity for U.S. electric utilities.

Q. Please summarize each of the steps listed above.

A. To select a comparable sample of electric utilities, I look to the universe of publicly traded electric utilities as classified by the Value Line Investment Survey.[42] This resulted in an initial group of 46 companies. From this group, I kept those that meet the following criteria: (1) have five years of data available for examination, (2) have an investment grade rating, (3) have substantial regulated assets, and (4) have sufficient size such that market data are meaningful. I exclude companies with unique circumstances that may bias the cost of capital estimation such as substantial merger or acquisitions, recent dividend cuts or other unique factors (e.g., substantial litigation).[43]

To estimate the cost of equity for the sample, I rely on two versions of the Discounted Cash Flow (DCF) model and three versions of the risk premium model. I further confirm

[42] The 46 companies are from Value Line Investment Analyzer, Accessed as of November 19, 2014.
[43] For example, I exclude both NextEra and Hawaiian Electric due to the recently announced acquisition of Hawaiian Electric by NextEra.

these figures by comparing the estimates to the recently allowed ROE for electric utilities and to estimates obtained from two versions of the Capital Asset Pricing Model (CAPM). Specifically, I calculate the DCF cost of equity using the standard (single-stage) Gordon growth model and a three-stage DCF model. Further, I implement three versions of the risk premium model using realized and authorized returns, respectively.

As noted above, the cost of equity capital for a company depends on its financial leverage. As the sample's DCF (and CAPM) measures of cost of equity was estimated using the sample companies' market value capital structure I determine the current capital structure (and the five-year average capital structure). I can then use these figures to convert the sample's cost of equity estimate to an estimate for PGE using its 50-50 capital structure. I then look to PGE's level of risk relative to the sample and consider PGE's smaller size, slightly higher relative risk as estimated by beta, and need to integrate substantial new generation in its portfolio.[44]

Finally, I consider the reasonableness of the estimated cost of equity for PGE in light of recently allowed ROE for electric utilities and in the light of the changing electric industry. For example, the electric industry is facing significant environmental expenditures, the risk of competition from self-generation, and a substantial change in the generation fleet, which may mean that historical measures of the cost of equity as reflected in a risk premium analysis may not be representative of the industry's cost of equity going forward.

[44] SNL Financial, "Company Report – Portland General Electric – Transitioning away from reliance on purchased power." December 19, 2014. While Portland General in the past has relied more heavily on Power Purchase Agreements than its peers, it has built substantial generation that will come online before or at the time the rates from this proceeding are expected to be in effect.

B. Sample Selection

Q. Please describe how you selected your sample.

A. To select a comparable sample of electric utilities, I began with the universe of publicly traded electric utilities as classified by Value Line.[45] This resulted in an initial group of 46 companies. From this group, I kept those that are Regulated (at least 80% of assets are regulated) or Mostly Regulated (50-79% of assets are regulated) as determined by EEI.[46] In addition, I require that the selected companies have five years of data available, an investment grade rating, and sufficient size that market data are meaningful. I exclude companies with unique circumstances that may bias the cost of capital estimation such as substantial merger or acquisitions, dividend cuts or other unique factors (e.g., substantial litigation). Value Line companies that merged as well as entities with an acquisition or merger larger than 30% of their market capitalization was excluded as were entities that had announced dividend cuts or companies with non-investment grade bond ratings.

Q. Please summarize the characteristics of your sample.

A. The electric sample is comprised of regulated companies whose primary source of revenues and majority of assets are in the regulated portion of the electric industry. The final sample consists of the 29 electric utilities listed in Table 2 below.

The 2013 annual revenue as well as the market cap was obtained from Bloomberg as were the recent credit rating and growth estimate. Betas were obtained from Value Line.

[45] The 46 companies are from *Value Line Investment Analyzer*, Accessed as of November 19, 2014.
[46] *Edison Electric Institute*, Stock Performance - Q2 2014 Financial Update.

Table 2: Electric Sample and Its Characteristics[47]

Company	Regulated Assets	Market Cap. (3Q 2014) ($MM)	S&P Credit Rating (2013)	Long Term Growth Est	Value Line Betas
ALLETE	R	2,048	BBB+	6.0%	0.80
Alliant Energy	R	6,291	A-	5.8%	0.80
Amer. Elec. Power	R	25,812	BBB	4.8%	0.70
Ameren Corp.	R	9,318	BBB+	7.3%	0.75
CenterPoint Energy	MR	10,424	A-	6.0%	0.75
CMS Energy Corp.	R	8,161	BBB	6.0%	0.75
Consol. Edison	R	16,614	A-	5.5%	0.60
Dominion Resources	MR	40,119	A-	3.1%	0.70
DTE Energy	R	13,475	BBB+	5.3%	0.75
Edison Int'l	R	18,584	BBB+	4.0%	0.75
El Paso Electric	R	1,481	BBB	6.3%	0.70
Entergy Corp.	R	13,736	BBB	8.0%	0.70
G't Plains Energy	R	3,813	BBB+	4.5%	0.85
IDACORP Inc.	R	2,753	BBB	4.8%	0.80
MGE Energy	MR	1,340	AA-	3.7%	0.70
OGE Energy	R	7,266	A-	6.2%	0.85
Otter Tail Corp.	R	1,007	BBB	6.4%	0.95
PG&E Corp.	R	21,682	BBB	4.5%	0.65
Pinnacle West Capital	R	6,196	A-	5.7%	0.70
Portland General	R	2,567	BBB	4.2%	0.80
Public Serv. Enterprise	MR	18,979	BBB+	5.5%	0.75
SCANA Corp.	MR	7,105	BBB+	7.0%	0.75
Sempra Energy	MR	25,772	BBB+	3.7%	0.75
Southern Co.	R	39,217	A	4.0%	0.60
Vectren Corp.	MR	3,336	A-	6.9%	0.80
Westar Energy	R	4,550	BBB+	4.5%	0.75
Xcel Energy Inc.	R	15,664	A-	6.3%	0.70

Notes: R – Regulated (at least 80% of assets are regulated), MR (50-79% of assets are regulated).

Q. How does the sample compare to PGE?

A. The sample was selected to consist of companies with more than 50% of their assets dedicated to regulated activities. As can be seen from Table 2, the majority of the sample companies are regulated as is PGE. The average credit rating is higher than that of PGE at an average of BBB+, while PGE maintains a BBB rating from S&P (A- from Moody's).

[47] Sources: *Value Line Investment Survey* as of December 9, 2014, Bloomberg as of December 9, 2014, and *Edison Electric Institute* as of December 9, 2014.

The majority of the companies are materially larger than PGE and only four companies have a market cap below that of PGE, while 19 companies have a market cap that exceeds twice that of PGE. Measured by beta, a measure of systematic risk, PGE is in the upper end of the sample, but its growth rate was slightly lower. However, the equity analysts that submit forecasts to Institutional Brokers Estimate System (IBES) as of year-end had increased PGE's growth rate to 7.97%.[48] Thus, PGE's systematic risk, size, and some growth rate sources indicate that PGE has a higher cost of equity than the comparable sample.

C. Capital Structure

Q. What regulatory capital structure has PGE requesting in this proceeding?

A. PGE has proposed a regulatory capital structure consisting of 50% equity and 50% debt,[49] which was the capital structure approved in the recent UE 283 proceeding.[50] This capital structure is broadly consistent with the book value capital structures of the sample companies. The sample averages about 48% equity on a book basis. The highest percentage of book equity for the companies in the sample is 61% equity (MGE Energy Inc.) and the lowest is 31% equity (CMS Energy Corp.).[51] However, the market based estimates of the cost of equity for the DCF (and CAPM) are based on the market value capital structure with include approximately 61% equity as of November 2014 and averaged approximately 55% equity over the last five years. My recommended range for ROE is a function of the requested capital structure, the sample average cost of capital estimates and the relative risk of PGE compared to the sample.

[48] IBES data from Yahoo Finance, December 31, 2014.
[49] The calculation of the capital structure is available in PGE Exhibit 1100, Hager – Valach – Greene, p. 22.
[50] Order 14-442, issued December 4, 2014, p. 3.
[51] See PGE Exhibit 1105.

V. Cost of Capital Estimates

Q. How do you estimate the sample companies' costs of equity?

A. As noted earlier, I implement three general methodologies: Discounted Cash Flow (DCF), Capital Asset Pricing Models (CAPM), and risk premium models. All methods are commonly used in U.S. state regulatory proceedings and have been presented to the Commission previously by PGE. For the DCF estimates, I present two models: the standard Gordon growth model (or the single-stage DCF) and a three-stage DCF model. I implement the three-stage DCF model using two different long-term growth rates: the consensus Blue Chip forecast and an average of the estimate from OMB and Blue Chip. Further, I estimate the ROE from three versions of the risk premium method: a regression analysis of allowed return on bond rates and a traditional look at earned and allowed ROE over treasuries. Finally, I estimate two versions of the CAPM as a check on my results: the traditional CAPM and two versions of the Empirical CAPM.[52] Because the cost of equity cannot be measured precisely, it is important to consider more than one method. Further, each method has its strengths and weaknesses, which may be more or less prevalent at any given time. It is therefore necessary to evaluate the estimated cost of equity in the light of the prevalent market conditions and the relative strengths and weaknesses of the model to take these factors into account.

A. The DCF Based Estimates

Q. Please describe the discounted cash flow approach to estimating the cost of equity.

[52] The CAPM is a commonly used cost of capital estimation model in corporate finance and I usually include it among my methods. However, the Commission has historically not relied upon the CAPM, so I present it only as a check on other results in this proceeding.

A. The DCF model takes the first approach to cost of capital estimation described above, i.e., to attempt to estimate the cost of capital in one step instead of estimating the cost of capital for the entire market and then determining the cost of capital for an individual investment. The DCF method assumes that the market price of a stock is equal to the present value of the dividends that its owners expect to receive. The method also assumes that this present value can be calculated by the standard formula for the present value of a cash flow stream:

$$P = \frac{D_1}{(1+r)} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \cdots + \frac{D_T}{(1+r)^T} \qquad (2)$$

where "P" is the market price of the stock; "D_i" is the dividend cash flow expected at the end of period i; "r" is the cost of capital; and "T" is the last period in which a dividend cash flow is to be received. The formula just says that the stock price is equal to the sum of the expected future dividends, each discounted for the time and risk between now and the time the dividend is expected to be received.

The standard DCF application goes on to make the assumption that the growth rate remains constant forever, which simplifies the standard formula, so that it can be rearranged to estimate the cost of capital. Specifically, if investors expect a dividend stream that will grow forever at a steady rate, then the market price of the stock will be given by the formula,

$$P = \frac{D_1}{(r-g)} \qquad (3)$$

where "D_1" is the dividend expected at the end of the first period, "g" is the perpetual growth rate, and "P" and "r" are the market price and the cost of capital, as before.

Equation (3) is a simplified version of equation (v-1) that can be solved to yield the well-known "DCF formula" for the cost of capital:

$$r = \frac{D_1}{P} + g = \frac{D_0 \times (1+g)}{P} + g \quad (4)$$

where "D_0" is the current dividend, which investors expect to increase at rate g by the end of the next period, and the other symbols are defined as before. Equation (4) says that if equation (3) holds, the cost of capital equals the expected dividend yield plus the (perpetual) expected future growth rate of dividends. I refer to this as the Gordon DCF model.

Q. Are there models other than the Gordon DCF model?

A. Yes. There are many alternatives, notably, (i) multi-stage models and (ii) models that use cash flow rather than dividends or combinations of (i) and (ii).[53] One such alternative expands the Gordon DCF model to three stages.[54] In the multistage model, earnings and dividends can grow at different rates, but must grow at the same rate in the final, constant growth rate period.

Q. What is your assessment of the DCF model?

A. The DCF approach is grounded in solid financial theory. It is widely accepted by regulatory commissions and provides useful insight regarding the cost of capital based on forward-looking metrics. DCF estimates of the cost of capital complement those of the Risk Premium or CAPM because the methods rely on different inputs and assumptions. The DCF method is particularly valuable in the current economic environment, because of the effects

[53] The Surface Transportation Board uses a cash flow based model with three stages. See, for example, Surface Transportation Board, "Ex Parte No. 664 (Sub-No. 1)," Issued January 23, 2009.

[54] I note that because investors are interested in cash flow, it is technically important to include all cash flow that is distributed to shareholders. Notably, many companies distribute cash through share buybacks in addition to dividends and therefore, I would include this type of distribution. However, among the comparable companies only El Paso Electric has share buybacks and including the amount would not affect the results. Therefore, I ignore this aspect for this proceeding.

on capital market conditions of the Fed's efforts to maintain interest rates at historically low levels which bias the Risk Premium (and CAPM-based) estimates downward.

However, I recognize that the DCF model, like most models, relies upon assumptions that do not always correspond to reality. This is why the reliance on multiple methods is important.

Q. What growth rate information do you use?

A. The first step in my DCF analysis (either constant growth or multistage formulations) is to examine a sample of investment analysts' forecasted earnings growth rates from Bloomberg and from Value Line for companies in the electric sample. For the long-term growth rate for the final, constant-growth stage of the multistage DCF estimates, I use two estimates: (i) the most recent long-run GDP growth forecast from Blue Chip Economic Indicators and (ii) the average of the OMB and Blue Chip long-term estimate.[55]

Q. How do these growth rates correspond to the theoretical criteria you discuss above?

A. The constant-growth formulation of the DCF model, in principle, requires forecasted growth rates, but it is also necessary that the growth rates used extend far enough into the future so that it is reasonable to believe that investors expect a stable growth path afterwards. Under current economic conditions, I believe the forecasted growth rates of investment analysts provide the best available representation of the longer term, steady-state growth rate expectations of investors.

Q. Does the multistage DCF improve upon the simple DCF?

[55] Blue Chip Economic Indicators, October 10, 2014 and the Fiscal Year 2015 Budget Forecast, March 2014. The latter has in the past been one of the estimates relied upon by Commission Staff.

A. Potentially, but the multistage method assumes a particular smoothing pattern and a long-term growth rate afterwards. These assumptions may not be a more accurate representation of investor expectation than those of the simple DCF. The smoother growth pattern, for example, might not be representative of investor expectations, in which case the multistage model would not increase the accuracy of the estimates. Indeed, amidst uncertainty in capital markets, assuming a simple constant growth rate may be preferable to attempting to model growth patterns in greater detail over multiple stages. While it is difficult to determine which set of assumptions comprises a closer approximation of the actual conditions of capital markets, I believe both forms of the DCF model provide useful information about the cost of capital.

Q. What are your DCF estimates?

A. The ROE estimate is 11.2% for the Gordon (single-stage) DCF model, and 9.8% and 10.0% for the multistage model using the Blue Chip long term GDP growth rate forecast, or the average of the Blue Chip and OMB forecasts, respectively.

Table 3: DCF Estimates on the Cost of Equity

	DCF		
	Simple	Multi-stage using forecasted GDP growth rate from Blue Chip	Multi-stage using average forecasted GDP growth rate from Blue Chip and OMB
Cost of Equity	11.2%	9.8%	10.0%

Q. What conclusions do you draw from the DCF analysis?

A. The estimate from the multi-stage model using a combined Blue Chip and OMB growth rate is consistent with recently allowed ROE for electric utilities, where the average without

Virginia specific generation incentive returns and without distribution only utilities is 10.0% for 2014. Further, the range and average are consistent with my point estimate of 10.25% and the multi-stage estimates supports PGE's requested ROE of 9.9%.

B. Risk Premium Methods

Q. Do you estimate the Cost of Equity that result from risk premium analyses?

A. Yes, I estimate three versions of the risk premium cost of equity. First, I estimate the risk premium using a statistical regression approach. Specifically, I calculate the statistical relationship between the allowed ROE for electric utilities and the 10-year government bond rate using quarterly data. This results in an estimated ROE of 10.7% for 2016-17. Second, I calculate the difference between the earned return on equity for electric utilities and the 10-year government bond yield. This results in a risk premium over the 20-year government bond yield. I add the forecasted 20-year government bond yield to the estimated risk premium to calculate a cost of equity of 10.6% for 2016-17. As a test on my regression analysis I also calculate the risk premium that has been granted by state regulatory commissions since 1997. Adding the forecasted risk-free rate to the historical risk premium of 6.37% for 1997-2014 (Q3), I find an ROE estimate of 10.0%.

Q. Please explain the implementation and data underlying your first risk premium analysis.

A. Using quarterly data from Regulatory Research Associates from Q1 1990 to Q3 2014,[56] I estimate the equation:

$$\text{Risk Premium} = A_0 + A_1 \times (\text{Treasury Bond Yield})$$

[56] SNL Financial as of December 3, 2014.

The equation is estimated using ordinary least squares and the parameters are statistically significant (details are in PGE Exhibit 1102). Using this approach I estimate a risk premium of 6.37%, which when added to the forecasted 10-year yield in 2016-17 as PGE's rates are expected to be in effect over that period. As the forecasted 10-year yield average 4.64% for 2016-17,[57] I obtain a cost of equity estimate of 10.7%. As a check on this result, I also calculate the risk premium over the 1997 to 2014 period, which results in an ROE estimate of 10.6%. I used the period 1997 to today for this analysis because the FERC issued Rule 888 in 1996 and thereby made electric deregulation feasible. Subsequently, some states deregulated electric markets. It is plausible that deregulation had a substantial effect on electric utilities in deregulated markets, so I excluded the period prior to deregulation.

Q. What are the details of the last risk premium analysis?

A. Using data from Bloomberg,[58] I obtain the average annual return on equity earned by the electric utilities in my sample from 1997 to 2013.[59] I subtract the average annual yield on 20-year Treasury bonds from the earned equity return to obtain the risk premium. Using an average over the full period, I estimate a risk premium of 6.37%. I add the estimated risk premium to the forecasted yield on 20-year government bonds to obtain an estimated ROE of 10%.[60]

Q. Are these estimates consistent with PGE's regulatory capital structure of 50% equity and 50% debt?

[57] *Blue Chip Economic Indicators Forecast*, October 16, 2014.
[58] SNL Financial as of December 3, 2014.
[59] Regulatory Research Associates, "Major Rate Case Decisions – January-September 2014," October 10, 2014.
[60] See PGE Exhibit 1102 for details.

A. Yes, the allowed ROE pertains to the regulated capital structure of the entities for which state regulatory commissions allowed an ROE. The regulatory capital structures generally contain 48% to 52% equity with an average of near 50% equity in the last few years.[61] Therefore, the estimated ROE is consistent with PGE's capital structure.

Q. Please summarize the results from your risk premium analyses.

A. The results from my risk premium analyses are summarized in Table 4 below.

Table 4: Cost of Equity Estimates from Risk Premium Analyses

	Estimated ROE
Regression Analysis	10.7%
Premium over Allowed ROE	10.0%
Premium over Earned ROE	10.6%

Q. What conclusions do you draw from these analyses?

A. The three risk premium analyses confirm the range I have obtained from other analyses and makes clear that PGE's request for an ROE of 9.9% on 50% equity is reasonable and conservative, as the range is above PGE's requested ROE of 9.9%.

Q. Is there other relevant evidence regarding the current cost of equity for electric utilities?

A. Yes, looking at the recently allowed ROE for regulated electric utilities, I find that the recent evidence is consistent with an average allowed ROE of about 10%. This figure is consistent the average allowed ROE for all electric utilities as well as with the average when Virginia's

[61] Regulatory Research Associates, "Major Rate Case Decisions – January-September 2014," October 10, 2014, p. 4.

generation incentive ROEs as well as distribution only ROE are excluded.[62] Finally, I estimate the cost of equity using the Capital Asset Pricing Model, which determines the cost of equity as follows:

$$r_S = r_f + \beta_S \times MRP$$

where r_s is the cost of capital for investment S; r_f is the risk-free rate; β_S is the beta risk measure for the investment S; and MRP is the market risk premium. The CAPM relies on the empirical fact that investors price risky securities to offer a higher expected rate of return than safe securities. I estimate this model using Value Line betas, the risk-free rate that Blue Chip forecast for 2016-17 (as in the risk-premium analyses above), and the historical MRP for the period 1926-2013 as reported by the 2014 Duff & Phelps Valuation Handbook.[63] I also implement two variations of the model that relies on the empirical observation that the intercept in Figure 1 is higher than in the theoretical CAPM but the slope is lower. The CAPM and the empirical CAPM results in cost of equity estimates in the range of 9.8% to 10.2%, which confirms that PGE's requested ROE of 9.9% is reasonable. The details of this model are in PGE Exhibits 1103 and 1104.

VI. Conclusions

Q. Please summarize the evidence from the sample regarding the ROE for an electric utility of average risk?

A. Tables 3 and 4 summarize the results of the analyses for the DCF and risk premium models for the sample of electric utilities. The results from the CAPM and risk premium models are within the range obtained from the DCF models. As a result the overall range of cost of

[62] Source: SNL Energy. See PGE Exhibit 1105 for details.
[63] *Blue Chip Economic Indicators*, October 10, 2014; Duff & Phelps, 2014 Valuation Handbook, Exhibit 3-6.

equity estimates is 10.0% to 10.7% ignoring the lowest and highest estimate, so that a point estimate of 10.25% is reasonable. The overall range is wider, 9.8% to 11.2%, and includes PGE's requested ROE of 9.9%. This range is also consistent with the recently allowed ROE for U.S. electric utilities. Because PGE is smaller than the average sample company and a higher systematic risk, I believe a range of 10.0% to 10.7% is more appropriate.

Overall, I believe PGE's request for an ROE of 9.9% is reasonable and a bit conservative.

Q. Does this conclude your testimony?

A. Yes.

Resume of Dr. Bente Villadsen

Dr. Bente Villadsen's work concentrates in the areas of regulatory finance and accounting. Her recent work has focused on accounting issues, damages, cost of capital and regulatory finance. In the regulatory finance area, Dr. Villadsen has testified on cost of capital and accounting, analyzed credit issues in the utility industry, risk management practices as well the impact of regulatory initiatives such as energy efficiency and de-coupling on cost of capital and earnings. Among her recent accounting work, she has been involved in accounting disclosure issues and principles including impairment testing, fair value accounting, leases, accounting for hybrid securities, accounting for equity investments, cash flow estimation as well as overhead allocation. Dr. Villadsen has estimated damages in the U.S. as well as internationally for companies in the construction, telecommunications, energy, cement, and rail road industry. She has filed testimony and testified in federal and state court, in international and U.S. arbitrations and before state and federal regulatory commissions. Her testimonies and expert reports pertain to accounting issues, damages, discount rates and cost of capital for regulated entities.

Dr. Villadsen holds a Ph.D. from Yale University's School of Management with a concentration in accounting. She has a joint degree in mathematics and economics (BS and MS) from University of Aarhus in Denmark. Prior to joining The Brattle Group, she was a Professor of Accounting at the University of Iowa, University of Michigan, and at Washington University in St. Louis where she taught financial and cost accounting. She has also taught graduate classes in econometrics and quantitative methods. Dr. Villadsen also worked as a consultant for Risoe National Laboratories in Denmark.

AREAS OF EXPERTISE

- Regulatory Finance
  - Cost of Capital
  - Cost of Service (including prudence)
  - Energy Efficiency, De-coupling and the Impact on Utilities Financials
  - Relationship between regulation and credit
  - Risk Management
  - Regulatory Advisory
- Accounting and Corporate Finance
  - Application of Accounting Standards
  - Disclosure Issues
  - Credit Issues in the Utility Industry
- Damages

- Stock Price Drop
- Lost Profit

EXPERIENCE

Regulatory Finance

- On behalf of American Water, California Water, EPCOR, and Portland General Electric, Dr. Villadsen has testified on cost of capital in state regulatory proceedings. She has also submitted testimony to Bonneville Power Authority. In recent proceedings, her testimony included an evaluation of the impact of the financial crisis on the cost of capital and well as testimony on credit metrics and the implication of being non-investment grade.
- In Australia, she has submitted led and co-authored a report on cost of equity and debt estimation methods for the Australian Pipeline Industry Association. The equity report was filed with the Australian Energy Regulator as part of the APIA's response to the Australian Energy Regulator's development of rate of return guidelines and both reports were filed with the Economic Regulation Authority by the Dampier Bunbury Pipeline. She has also submitted a report on aspects of the WACC calculation for Aurizon Network to the Queensland Competition Authority.
- In connection with the AWC Companies application to construct a backbone electric transmission project off the Mid-Atlantic Coast, Dr. Villadsen submitted testimony before the Federal Energy Regulatory Commission on the treatment the accounting and regulatory treatment of regulatory assets, pre-construction costs, construction work in progress, and capitalization issues.
- On behalf of ITC Holdings, she filed testimony with the Federal Energy Regulatory Commission regarding capital structure issues.
- Testimony on the impact of transaction specific changes to pension plans and other rate base issues on behalf of Balfour Beatty Infrastructure Partners before the Michigan Public Service Commission.
- On behalf of financial institutions, Dr. Villadsen has led several teams that provided regulatory guidance regarding state, provincial or federal regulatory issues for integrated electric utilities or transmission assets. The work was requested in connection with the institutions evaluation of potential investments.

- Dr. Villadsen has authored or co-authored reports on rate of return in connection with a review of regulatory practice for both regulators and other parties. The reports were submitted to the Nederlands Competition Authority, the British Columbia Utilities Commission, the Canadian Transportation Agency, the Australian Energy Regulator, the Economic Regulation Authority of Western Australia, and the Communications Regulatory Authority of Italy.
- She has advised the private equity arm of two large financial institutions as well as an infrastructure company, a sovereign fund and pension fund in connection with their acquisition of regulated transmission, distribution or integrated electric assets in the U.S. and Canada. For these clients, Dr. Villadsen evaluated the regulatory climate and the treatment of acquisition specific changes affecting the regulated entity, capital expenditures, specific cost items and the impact of regulatory initiatives such as the FERC's incentive return or riders and trackers. She has also reviewed the assumptions or worked directly with the acquirer's financial model.
- In a matter before Bonneville Power Administration, Dr. Villadsen filed expert testimony on behalf of customers regarding the cost of capital for electric utilities and the appropriate discount rate to apply to a government entity's cash flows.
- For several large electric utility, Dr. Villadsen reviewed the hedging strategies for electricity and gas and modeled the risk mitigation of hedges entered into. She also studies the prevalence and merits of using swaps to hedge gas costs. This work was used in connection with prudence reviews of hedging costs in Colorado, Oregon, Utah, West Virginia, and Wyoming.
- She estimated the cost of capital for major U.S. and Canadian utilities, pipelines, and railroads. The work has been used in connection with the companies' rate hearings before the Federal Energy Regulatory Commission, the Canadian National Energy Board, the Surface Transportation Board, and state and provincial regulatory bodies. The work has been performed for pipelines, integrated electric utilities, non-integrated electric utilities, gas distribution companies, water utilities, railroads and other parties.
- In a matter pertaining to regulatory cost allocation, Dr. Villadsen assisted counsel in collecting necessary internal documents, reviewing internal accounting records and using this information to assess the reasonableness of the cost allocation.

- She has been engaged to estimate the cost of capital or appropriate discount rate to apply to segments of operations such as the power production segment for utilities.
- In connection with rate hearings for electric utilities, Dr. Villadsen has estimated the impact of power purchase agreements on the company's credit ratings and calculated appropriate compensation for utilities that sign such agreements to fulfill, for example, renewable energy requirements.
- Dr. Villadsen has been part of a team assessing the impact of conservation initiatives, energy efficiency, and decoupling of volumes and revenues on electric utilities financial performance. Specifically, she has estimated the impact of specific regulatory proposals on the affected utilities earnings and cash flow.
- On behalf of Progress Energy, she evaluated the impact of a depreciation proposal on an electric utility's financial metric and also investigated the accounting and regulatory precedent for the proposal.
- For a large integrated utility in the U.S., Dr. Villadsen has for several years participated in a large range of issues regarding the company's rate filing, including the company's cost of capital, incentive based rates, fuel adjustment clauses, and regulatory accounting issues pertaining to depreciation, pensions, and compensation.
- Dr. Villadsen has been involved in several projects evaluating the impact of credit ratings on electric utilities. She was part of a team evaluating the impact of accounting fraud on an energy company's credit rating and assessing the company's credit rating but-for the accounting fraud.
- For a large electric utility, Dr. Villadsen modeled cash flows and analyzed its financing decisions to determine the degree to which the company was in financial distress as a consequence of long-term energy contracts.
- For a large electric utility without generation assets, Dr. Villadsen assisted in the assessment of the risk added from offering its customers a price protection plan and being the provider of last resort (POLR).

Accounting and Corporate Finance

- In arbitration before the International Chamber of Commerce Dr. Villadsen testified regarding the true-up clauses in a sales and purchase agreement, she testified on the

distinction between accruals and cash flow measures as well as on the measurement of specific expenses and cash flows.

- On behalf of a taxpayer, Dr. Villadsen recently testified in federal court on the impact of discount rates on the economic value of alternative scenarios in a lease transaction.
- In an arbitration matter before the International Centre for Settlement of Investment Disputes, she provided expert reports and oral testimony on the allocation of corporate overhead costs and damages in the form of lost profit. Dr. Villadsen also reviewed internal book keeping records to assess how various inter-company transactions were handled.
- Dr. Villadsen provided expert reports and testimony in an international arbitration under the International Chamber of Commerce on the proper application of US GAAP in determining shareholders' equity. Among other accounting issues, she testified on impairment of long-lived assets, lease accounting, the equity method of accounting, and the measurement of investing activities.
- In a proceeding before the International Chamber of Commerce, she provided expert testimony on the interpretation of certain accounting terms related to the distinction of accruals and cash flow.
- In an arbitration before the American Arbitration Association, she provided expert reports on the equity method of accounting, the classification of debt versus equity and the distinction between categories of liabilities in a contract dispute between two major oil companies. For the purpose of determining whether the classification was appropriate, Dr. Villadsen had to review the company's internal book keeping records.
- In U.S. District Court, Dr. Villadsen filed testimony regarding the information required to determine accounting income losses associated with a breach of contract and cash flow modeling.
- Dr. Villadsen recently assisted counsel in a litigation matter regarding the determination of fair values of financial assets, where there was a limited market for comparable assets. She researched how the designation of these assets to levels under the FASB guidelines affect the value investors assign to these assets.

- She has worked extensively on litigation matters involving the proper application of mark-to-market and derivative accounting in the energy industry. The work relates to the proper valuation of energy contracts, the application of accounting principles, and disclosure requirements regarding derivatives.
- Dr. Villadsen evaluated the accounting practices of a mortgage lender and the mortgage industry to assess the information available to the market and ESOP plan administrators prior to the company's filing for bankruptcy. A large part of the work consisted of comparing the company's and the industry's implementation of gain-of-sale accounting.
- In a securities fraud matter, Dr. Villadsen evaluated a company's revenue recognition methods and other accounting issues related to allegations of improper treatment of non-cash trades and round trip trades.
- For a multi-national corporation with divisions in several countries and industries, Dr. Villadsen estimated the appropriate discount rate to value the divisions. She also assisted the company in determining the proper manner in which to allocate capital to the various divisions, when the company faced capital constraints.
- Dr. Villadsen evaluated the performance of segments of regulated entities. She also reviewed and evaluated the methods used for overhead allocation.
- She has worked on accounting issues in connection with several tax matters. The focus of her work has been the application of accounting principles to evaluate intra-company transactions, the accounting treatment of security sales, and the classification of debt and equity instruments.
- For a large integrated oil company, Dr. Villadsen estimated the company's cost of capital and assisted in the analysis of the company's accounting and market performance.
- In connection with a bankruptcy proceeding, Dr. Villadsen provided litigation support for attorneys and an expert regarding corporate governance.

Damages

- On behalf of a taxpayer, Dr. Villadsen testified on the economic value of alternative scenarios in a lease transaction regarding infrastructure assets.

- For a foreign construction company involved in an international arbitration, she estimated the damages in the form of lost profit on the breach of a contract between a sovereign state and a construction company. As part of her analysis, Dr. Villadsen relied on statistical analyses of cost structures and assessed the impact of delays.

- In an international arbitration, Dr. Villadsen estimated the damages to a telecommunication equipment company from misrepresentation regarding the product quality and accounting performance of an acquired company. She also evaluated the IPO market during the period to assess the possibility of the merged company to undertake a successful IPO.

- On behalf of pension plan participants, Dr. Villadsen used an event study estimated the stock price drop of a company that had engaged in accounting fraud. Her testimony conducted an event study to assess the impact of news regarding the accounting misstatements.

- In connection with a FINRA arbitration matter, Dr. Villadsen estimated the value of a portfolio of warrants and options in the energy sector and provided support to counsel on finance and accounting issues.

- She assisted in the estimation of net worth of individual segments for firms in the consumer product industry. Further, she built a model to analyze the segment's vulnerability to additional fixed costs and its risk of bankruptcy.

- Dr. Villadsen was part of a team estimating the damages that may have been caused by a flawed assumption in the determination of the fair value of mortgage related instruments. She provided litigation support to the testifying expert and attorneys.

- For an electric utility, Dr. Villadsen estimated the loss in firm value from the breach of a power purchase contract during the height of the Western electric power crisis. As part of the assignment, Dr. Villadsen evaluated the creditworthiness of the utility before and after the breach of contract.

- Dr. Villadsen modeled the cash flows of several companies with and without specific power contract to estimate the impact on cash flow and ultimately the creditworthiness and value of the utilities in question.

PUBLICATIONS AND REPORTS

"Aurizon Network 2014 Draft Access Undertaking: Comments on Aspects of the WACC," prepared for Aurizon Network and submitted to the *Queensland Competition Authority*, December 2014

Report on "Cost of Capital for Telecom Italia's Regulated Business" with Stewart C. Myers and Francesco Lo Passo before the *Communications Regulatory Authority of Italy* ("AGCOM"), March 2014. *Submitted in Italian.*

"Alternative Regulation and Ratemaking Approaches for Water Companies: Supporting the Capital Investment Needs of the 21st Century," (with J. Wharton and H. Bishop), prepared for the *National Association of Water Companies*, October 2013.

"Estimating the Cost of Debt," (with T. Brown), prepared for the Dampier Bunbury Pipeline and filed with the *Economic Regulation Authority*, Western Australia, March 2013.

"Estimating the Cost of Equity for Regulated Companies," (with P.R. Carpenter, M.J. Vilbert, T. Brown, and P. Kumar), prepared for the Australian Pipeline Industry Association and filed with the *Australian Energy Regulator* and the *Economic Regulation Authority*, Western Australia, February 2013.

"Calculating the Equity Risk Premiumand the Risk Free Rate," (with Dan Harris and Francesco LoPasso), prepared for *NMa and Opta, the Netherlands*, November 2012.

"Shale Gas and Pipeline Risk: Earnings Erosion in a More Competitive World," (with Paul R. Carpenter, A. Lawrence Kolbe, and Steven H. Levine), *Public Utilities Fortnightly*, April 2012.

"Survey of Cost of Capital Practices in Canada," (with Michael J. Vilbert and Toby Brown), prepared for *British Columbia Utilities Commission*, May 2012.

"Public Sector Discount Rates" (with rank Graves, Bin Zhou), *Brattle* white paper, September 2011

"FASB Accounting Rules and Implications for Natural Gas Purchase Agreements," (with Fiona Wang), *American Clean Skies Foundation*, February 2011.

"IFRS and You: How the New Standards Affect Utility Balance Sheets," (with Amit Koshal and Wyatt Toolson), *Public Utilities Fortnightly*, December 2010.

"Corporate Pension Plans: New Developments and Litigation," (with George Oldfield and Urvashi Malhotra), Finance Newsletter, Issue 01, *The Brattle Group*, November 2010.

"Review of Regulatory Cost of Capital Methodologies," (with Michael J. Vilbert and Matthew Aharonian), *Canadian Transportation Agency*, September 2010.

"Building Sustainable Efficiency Businesses: Evaluating Business Models," (with Joe Wharton and Peter Fox-Penner), *Edison Electric Institute*, August 2008.

"Understanding Debt Imputation Issues," (with Michael J. Vilbert and Joe Wharton and *The Brattle Group* listed as an author), *Edison Electric Institute*, June 2008.

"Measuring Return on Equity Correctly: Why current estimation models set allowed ROE too low," *Public Utilities Fortnightly*, August 2005 (with A. Lawrence Kolbe and Michael J. Vilbert).

"The Effect of Debt on the Cost of Equity in a Regulatory Setting," (with A. Lawrence Kolbe and Michael J. Vilbert, and with "*The Brattle Group*" listed as author), *Edison Electric Institute,* April 2005.

"Communication and Delegation in Collusive Agencies," *Journal of Accounting and Economics*, Vol. 19, 1995.

"Beta Distributed Market Shares in a Spatial Model with an Application to the Market for Audit Services" (with M. Hviid), *Review of Industrial Organization*, Vol. 10, 1995.

SELECTED PRESENTATIONS

"Alternative Regulation and Rate Making Approaches for Water Companies," *Society of Depreciation Professionals Annual Conference*, September 2014.

"Advanced Capital Structure and Liability Management," *American Gas Association and Edison Electric Institute Advanced Public Utility Accounting Course*, August 2014.

"Capital Investments and Alternative Regulation," *National Association of Water Companies Annual Policy Forum*, December 2013.

"Current Issues in Cost of Capital," *Edison Electric Institute Advanced Rate School*, July 2014, 2013, 2012.

"Accounting for Power Plant," *SNL's Inside Utility Accounting Seminar*, Charlotte, NC, October 2012.

"GAAP / IFRS Convergence," *SNL's Inside Utility Accounting Seminar*, Charlotte, NC, October 2012.

"International Innovations in Rate of Return Determination," *Society of Utility Financial and Regulatory Analysts' Financial Forum*, April 2012.

"Utility Accounting and Financial Analysis: The Impact of Regulatory Initiatives on Accounting and Credit Metrics," 1.5 day seminar, EUCI, Atlanta, May 2012.

"Cost of Capital Working Group Eforum," *Edison Electric Institute webinar*, April 2012.

"Issues Facing the Global Water Utility Industry" Presented to Sensus' Executive Retreat, Raleigh, NC, July 2010.

"Regulatory Issues from GAAP to IFRS," NASUCA *2009 Annual Meeting*, Chicago, November 2009.

"Subprime Mortgage-Related Litigation: What to Look for and Where to Look," *Law Seminars International: Damages in Securities Litigation*, Boston, May 2008.

"Evaluating Alternative Business / Inventive Models," (with Joe Wharton). *EEI Workshop, Making a Business of Energy Efficiency: Sustainable Business Models for Utilities*, Washington DC, December 2007.

TESTIMONY

Verified Statement and Verified Reply Statement on the cost of capital calculation for railroads submitted to the *Surface Transportation Board* on behalf of the Association of American Railroads, Docket No. EP 664 (Sub-No. 2), September and November 2014.

Supplemental Direct Testimony on cost of capital submitted to the *Regulatory Commission of Alaska* on behalf of Anchorage Water and Wastewater utilities, Docket U-13-202, September 2014.

Expert Report and hearing appearance on specific accrual and cash flow items in a Sales and Purchase Agreement in international arbitration before the *International Chamber of Commerce*. Case No. 19651/TO, July and November 2014.

Rebuttal Testimony regarding Cost of Capital before the *Oregon Public Utility Commission* on behalf of Portland General Electric, Docket No. UE 283, July 2014.

Direct Testimony on the rate impact of the pension re-allocation and other items for Upper Peninsula Power Company in connection with the acquisition by BBIP before the *Michigan Public Service Commission* in Docket No. U-17564, March 2014.

Expert Report on cost of equity, non-recovery of operating cost and asset retirement obligations on behalf of oil pipeline in arbitration, April 2013.

Direct Testimony on the treatment of goodwill before the *Federal Energy Regulatory Commission* on behalf of ITC Holdings Corp and ITC Midwest, LLC in Docket No. PA10-13-000, February 2012.

Direct and Rebuttal Testimony on cost of capital before the *Public Utilities Commission of the State of California* on behalf of California-American Water in Application No. 11-05, May 2011.

Direct Testimony, Rebuttal Testimony, and Hearing Appearance on cost of capital before the *New Mexico Public Regulation Commission* on behalf of New Mexico-American Water in Case No. 11-00196-UT, May 2011, November 2011, and December 2011.

Direct Testimony on regulatory assets and FERC accounting before the *Federal Energy Regulatory Commission* on behalf of AWC Companies, ER11-13-000/Eli-1-3-000, December 2010.
Expert Report and deposition in Civil Action No. 02-618 (GK/JMF) in the *United States District Court for the District of Columbia*, November 2010, January 2011.

Direct Testimony, Rebuttal Testimony, and Rejoinder Testimony on the cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-10-0448, November 2010, July 2011, and August 2011.

Direct Testimony on the cost of capital before *the New Mexico Public Regulation Commission* on behalf of New Mexico-American Water in Docket No. 09-00156-UT, August 2009.

Direct and Rebuttal Testimony and Hearing Appearance on the cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-09-0343, July 2009, March 2010 and April 2010.

Rebuttal Expert Report, Deposition and Oral Testimony re. the impact of alternative discount rate assumptions in tax litigation. *United States Court of Federal Claims*, Case No. 06-628 T, January, February, April 2009. (*Confidential*)

Direct Testimony, Rebuttal Testimony and Hearing Appearance on cost of capital before the *New Mexico Public Regulation Commission* on behalf of New Mexico-American Water in Docket No. 08-00134-UT, June 2008 and January 2009.

Direct Testimony on cost of capital and carrying charge on damages, U.S. Department of Energy, *Bonneville Power Administration*, BPA Docket No. WP-07, March 2008.

Direct Testimony, Rebuttal Testimony, Rejoinder Testimony and Hearing Appearance on cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-08-0227, April 2008, February 2009, March 2009.

Expert Report, Supplemental Expert Report, and Hearing Appearance on the allocation of corporate overhead and damages from lost profit. *The International Centre for the Settlement of Investment Disputes*, Case No. ARB/03/29, February, April, and June 2008 (*Confidential*).

Expert Report on accounting information needed to assess income. *United States District Court* for the District of Maryland (Baltimore Division), Civil No. 1:06cv02046-JFM, June 2007 (*Confidential*)

Expert Report, Rebuttal Expert Report, and Hearing Appearance regarding investing activities, impairment of assets, leases, shareholder' equity under U.S. GAAP and valuation. *International Chamber of Commerce* (ICC), Case No. 14144/CCO, May 2007, August 2007, September 2007. (Joint with Carlos Lapuerta, *Confidential*)

Direct Testimony, Rebuttal Testimony, and Hearing Appearance on cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-06-0491, July 2006, July 2007.

Direct Testimony, Rebuttal Testimony, Rejoinder Testimony, Supplemental Rejoinder Testimony and Hearing Appearance on cost of capital before the *Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-06-0403, June 2006, April 2007, May 2007.

Direct Testimony, Rebuttal Testimony, Rejoinder Testimony, and Hearing Appearance on cost of capital before *the Arizona Corporation Commission* on behalf of Arizona-American Water in Docket No. W-01303A-06-0014, January 2006, October 2006, November 2006.

Expert report, rebuttal expert report, and deposition on behalf of a major oil company regarding the equity method of accounting and classification of debt and equity, *American Arbitration Association*, August 2004 and November 2004. (*Confidential*).