APPENDIX C
RELATIVE RISK ASSESSMENT FOR A BENCHMARK UTILITY

Introduction

In risk premium models the relative risk coefficient adjusts the overall market risk premium up or down depending on whether the individual security (company) is more or less risky than the overall market. More risky stocks have a relative risk coefficient greater than 1.0 and less risky stocks a relative risk coefficient less than 1.0. Averaging over all securities in the market using market value weights gives a relative risk coefficient *by definition* of 1.0. All risk premium models have this same risk assessment relative to the market, whether they are the capital asset pricing model (CAPM)[1] where the only source of risk is the market risk, or models that introduce other sources of risk. However, even within a two factor model, where the long Canada bond is regarded as risky due to interest rate risk,[2] or the Fama-French three factor model[3] where size and the market to book ratio (in their model termed the book to market ratio) are additional sources of risk, the coefficient on the market is still the main measure of risk. Estrada,[4] for example, shows that for the DOW 30 US stocks the simple CAPM expected return at 9.70% is only 0.20% more than the estimate from the three factor Fama-French Model and that the market risk premium is larger than either the size or book to market premiums.

Since the overall market return is the benchmark, the relative risk assessment is with respect to this benchmark. Statistically this relative risk coefficient is the *expected* or forecast covariance[5] between the security's return and that on the market scaled by the variance of the return on the market. This is called the security's beta coefficient (β) and measures the contribution of the security to the risk of a diversified portfolio. We normally estimate actual historic beta estimates

[1] William Sharpe, "Capital asset prices: a theory of market equilibrium under conditions of risk," Journal of Finance 19, 1964.

[2] Fisher Black, "Capital market equilibrium with restricted borrowing", Journal of Business, July 1972.

[3] Eugene Fama and Ken French, "The cross section of expected stocks returns," Journal of Finance 59, 1992.

[4] "The three-factor model: a practitioners guide," Journal of Applied Corporate Finance, Spring 2011.

[5] The covariance measures the degree to which two securities move together.

by a simple ordinary least squares (OLS) regression of the security's return against that of the market. In any OLS regression the intercept is called *alpha* and the slope coefficient is called *beta*, which is why these terms are used pervasively in finance. However, estimating actual beta coefficients entails the exact same estimation problems as estimating the market risk premium, since *both* use actual or historic returns. What this means is that any estimate is very sensitive to what happened during the estimation period. For example, if something like a major stock market crash happens once every 20 years then beta coefficients estimated over the last five years will only capture this 25% of the time. The other 75% of the time the betas will be estimated over a period that does *not* include a major stock market crash.

We overcome this problem when estimating the market risk premium by going back over very long periods of time. This is possible because the basic risk return trade-off in the capital market is regarded as relatively constant. However, for estimating beta coefficients this is more problematic since the risk of a firm or industry changes much more than the overall risk of the market. Instead, we tend to use estimates from similar firms and industries as well as more judgment in understanding the economic and financial factors underlying the beta estimates. In this way we get a better understanding of the *expected* beta coefficient, which is what is required.

Historic Beta Estimates for Canadian utilities

In 2002 the Toronto Stock Exchange outsourced its market indexes to Standard and Poors (S&P) and changed their composition. These changes roughly coincided with the loss of many traditional Canadian utilities. It was also controversial in transferring Enbridge Inc and TransCanada (now TC Corporation) from pipelines, where they were regarded as similar to utilities, into energy services.

Regardless of these changes, the great advantage of the sub-indexes is that they include more companies than is normally possible with individual companies since companies are constantly being reorganised as business strategy changes. This is particularly important because many Canadian regulated firms, like Consumers Gas, Maritime Electric, Bell Canada, Union Gas, Pacific Northern Gas, Fort Chicago Energy Partners (Veresen now Pembina), BC Gas, Maritime T&T, Newfoundland Power etc., have all disappeared through corporate reorganisation.

Although this means that their individual company betas disappeared, it does not mean that their economic impact has also disappeared. Consumers Gas now shows up as part of Enbridge Inc, BC Gas as Fortis etc., so their economic impact continues to show up in the sub index betas. However, there is a disadvantage, which is that these are not simple averages but *market value weighted* averages, since this is the way that stock market indexes are normally calculated. As a result, large market value companies have a disproportionate impact on the indexes.

In Schedule 1 is a graph of rolling betas on the Canadian utility sub index since 1988. Betas are normally estimated over the prior five years since the basic data sources historically used monthly data,[6] so the first observation is from January 1988 until December 1992 and then each month as a new return is available the five-year estimation window moves forward a year. This process is repeated using two estimation techniques; the first Beta is the simple beta against the Canadian market index, whereas the second Beta 2 also includes the impact of interest rate changes by adding the monthly return on the long Canada bond as a second risk factor. In previous rate hearings one argument for mechanically adjusting betas was this interest rate effect. However, to all intents and purposes the beta estimates are almost the same, but it does allow an estimate of the sensitivity of utility shares to interest rates, which I discuss later, and refer to as "gamma."

Using this procedure using 34 years of data (1988-2021) I can pick up the impact of unique events. For example, the utility betas were both in a range of 0.40-0.60 until 1997. The betas then dropped to negative values during 2001-2004 before reverting to more "normal" levels. Did this mean that utility shares had no risk during this period and deserved a negative market risk premium? The answer to this question is no, since a special event: the behaviour of Nortel and the Internet Bubble, drove the estimates. During the late 1990s, the technology and internet boom were driving North American markets up as the prices of Nortel and JDS Uniphase[7] increased and their market value came to represent 1/3 of the value of the Canadian stock

[6] In Canada this is the TSX/Western data base and in the U.S. the Center for Research in Security Prices (CRSP) data base at the University of Chicago.

[7] JDS Uniphase resulted from a merger of the Canadian fibre optic company JDS Fitel in 1999.

market. When this boom turned into a crash and Nortel declined from $1,240 to zero with its bankruptcy, Nortel took the Canadian market down with it.

It is important to understand that historic beta estimates measure the risk of a security relative to the risk of a diversified portfolio, in this case the TSX Composite. Utility betas were pulled down as Nortel and the tech boom dominated the Canadian market driving it up and then down when they crashed, while utility shares were not affected. This accurately estimated a low covariance and low beta. As the effect of the internet bubble and crash passed through the five-year estimation window utility betas reverted to a more normal pattern. By 2008 the beta estimates covering the period 2004-2008 were largely devoid of the effects of the Internet Bubble since the tech wreck had removed Nortel's influence. The message was that during this period utility shares added very little risk to a diversified portfolio since that portfolio was dominated by the effect of Nortel and JDS Uniphase. However, as this bubble and crash period receded utility shares added their normal amount of risk to a diversified portfolio, not because their risk had changed but their risk *relative* to the overall market changed.

Finally, utilities are clearly interest sensitive stocks as the consistent positive ***gamma*** coefficients indicate. This indicates that like the long Canada bond, utility prices tend to go up with interest rate decreases and down with interest rate increases. It is also clear that this interest rate sensitivity exhibits a negative correlation with the beta estimates, that is, beta coefficients tend to fall as gamma coefficients increase. This is because interest rates tend to increase during good times as the stock market booms and then fall in recessions. As a result, utilities are classic defensive stocks where interest rate declines during a recession cushions their share prices.

This statistical result echoes the comment of former RBC utility analyst Maureen Howe who commented that Canadian utilities are[8]

> "like convertible bonds. When interest rates are low, as they currently are, the companies trade on their bond value and are supported by tax-efficient dividend yields. When the 10-year GOC yield rises above 6%-6.5%, the Canadian companies trade on the basis of their underlying earnings and P/E."

[8] October 3, 2001, RBC Morning Comment.

I would agree with Howe's comments with the qualification that we have not had Government of Canada (GOC) yields above 6% since 2000. Consequently, the search for yield has led utility shares to trade on their interest sensitivity or "income" support.

In Schedule 2 are the results of two multiple regression estimates of utility risk. The first panel has the estimates for the overall period from 1988 where the utility beta against the Toronto Stock Exchange (TSX) return is 0.30 and the gamma or interest sensitivity against the long Canada bond return is 0.46. This means that over the whole period utilities had 30% of the exposure of an average stock to the market and 46% of the exposure of the long Canada bond to interest rates. However as noted previously this period reflects the Internet Bubble and crash which may bias the results.[9] In the second panel are the estimates for the last five-year period ending in January 2022. For this period the beta estimate is 0.49 closer to traditional levels and the gamma 0.54. Note that in all cases both the beta and gamma coefficients are highly significant.

A second criticism often levelled against Canadian beta estimates is the "hollowing out" of the Canadian stock market as many long time prime Canadian companies like Inco and Alcan have been bought by foreign acquirers. If the Nortel/JDS Uniphase and hollowing out effects distort Canadian beta estimates we can look at the returns against the U.S. market index. This might reduce the impact due to the "greater diversity" of the U.S. market. To examine this, the graph in Schedule 3 uses the hedged U.S. market index (S&P500) instead of the TSX composite. However, the Internet Bubble effect is just as evident since regardless of whether we view the TSX or the U.S. stock market as the correct market portfolio, utility betas turned negative at that time. Moreover, the most recent beta estimates are lower against the U.S. market index, whether estimated from a single or two factor model (0.24-0.29), than against the Canadian market index (0.50). This is possibly due to the current FAANG dominated US market[10] that is causing a "Nortel" effect.

[9] A median regression puts a higher coefficient of 0.4 on the beta.

[10] FAANG stands for Facebook, Amazon, Apple, Netflix and Google.

We can see the same effect in the average beta estimates for the individual firms rather than the index in Schedule 3, where I have split the few remaining Canadian utility-like stocks into pipeline and utility holding company (UHC) samples. The individual values estimated, since the 1996-2000 period, are in Schedule 4. The low risk UHC sample consists of Canadian Utilities (CU), Fortis (FTS), Emera (EMA) and Gaz Metro (GMI) through Valener (VNR).[11] The Pipeline sample consists of TransCanada Corporation (TRP), Enbridge Inc. (ENB), Fort Chicago (Veresen) and Pembina (PPL), which almost doubled its size by purchasing Veresen in 2017. During the internet bubble period and crash both samples show very low and negative betas, but once these events passed out of the estimation window they recovered to more normal levels. For the UHCs recent average betas have been around 0.30, whereas the betas of the pipeline sample have recently been much higher and average over 1.0, reflecting all the uncertainties surrounding pipeline expansions in both the US and Canada and the expansion of Pembina.

Consistent with the data in Schedules 1-5, I judge the interest sensitivity of these companies has caused them to trade based on their defensive or income characteristics during this recent period of very low interest rates. As interest rates increase back to normal levels, I would expect their betas to increase as they trade less on their bond values and more as regular equities. I would therefore expect some tendency for their betas to revert to their long run average level: for the market this is 1.0, but for regulated firms I have normally judged this to be about 0.50.

U.S. utility stocks as a comparison

Given the diminishing number of Canadian utility stocks I have been forced to look at samples of U.S. utility holding companies. In doing this I have traditionally used the intersection of two samples used previously by Ms. McShane and Dr. Vilbert both of whom have appeared before Canadian boards on behalf of utilities. The intent here has been to avoid cross examination on the risks of these companies as the intersection of theser two "samples" might be regarded as a smaller and unambiguously purer set of low-risk U.S. utilities. However, the U.S. has not been immune from the M&A activity that has reduced the number of Canadian UHCs. For example, the sample of U.S. gas UHCs that I used as recently as 2016 has been reduced by the purchase by

[11] As of November 29, 2017, GMI is now known as Energir.

AltaGas of WGL on July 6, 2018, the purchase of Piedmont Natural Gas by Duke Energy on October 31, 2016, and the merger between Vectren and Centre Point Energy on April 23, 2018. Marginally off setting the loss of those three companies is the creation of One Gas (OGS) in March 2014.

Schedule 6 provides a graph of the median and average beta estimates for the US gas companies back to 1990 with the most recent betas in Schedule 7. The graph includes the three "legacy" gas companies which have recently merged or been acquired. The betas are estimated in the same way as for the Canadian betas from monthly holding period returns over a five year time period updated monthly. The estimates from these U.S. gas utilities behave in a similar manner as for the Canadian utility holding companies. This is clear from the observation that they also exhibit an "internet bubble" effect, although not quite as severe as for the Canadian UHCs. However, the most recent average level of the betas from these companies is higher than those for the Canadian utility holding companies at 0.46.

Adjusted betas

It is always necessary to adjust the estimated betas, particularly recent ones, since they are only estimates of what happened over a particular time, whereas what is needed is an estimate of what is likely to happen in the future. One such adjustment is justified by the seminal work of Marshall Blume[12] who showed that if there is measurement error when we estimate a very low beta the chances are the "true" beta is underestimated and vice versa. By looking at betas estimated at time T he estimated the following regression equation, where the dependent variable is the beta estimated over a previous period: such as five years earlier (T-5).

$$\beta_T = \alpha_1 + \alpha_2 \beta_{T-5}$$

The coefficients he estimated were approximately

[12] Marshall Blume, Betas and their regression tendencies, Journal of Finance, June 1975 .

$$\alpha_1 = 0.33$$
$$\alpha_2 = 0.67$$

With these values the "true" beta is when the two betas are the same, so with these parameter estimates (.33/(1-.67)) the true beta is equal to 1. Blume actually estimated his equation over all stocks so the equation verges on being a tautology, since the average value of betas estimated over all stocks should be about 1.0.

The result is a *general* adjustment equation for *all* stocks assuming you know absolutely nothing about them, where we adjust the actual betas by taking 2/3 of that estimated and add 0.33. Essentially, this means weighting 1/3 with the average market beta of 1.0 and 2/3 with the actual beta. This procedure means that low betas are *always* increased and high betas reduced *regardless* of whether the true beta is actually the observed low or high beta! That is the procedure ignores any information that you have about the estimated betas and the firm.

However, low beta estimates for utilities do not mean they are under-estimated and need adjusting upwards toward 1.0, since utility betas are perennially low due to their low risk and this is not caused by estimation error. Instead, as Gombola and Kahl[13] demonstrated utility betas are better mechanically adjusted by weighting with their grand mean. If I were to do this with recent betas in a range 0.32-0.58 and a long run beta of 0.52, we would get an adjusted beta as follows:

Adjusted beta = 0.67 * 0.49 +0.33 * .52 = 0.50 for the utility sub index

Adjusted beta = 0.67 * 0.32 + 0.33 * 0.5 = 0.38 for the individual large companies

This type of adjustment is also consistent with the more recent work of Michelfielder and Theodossiou[14] who looked specifically at whether the Blume adjustment mechanism worked for US utility betas. They looked at betas estimated for utility holding companies over 5, 7, 8 and 9-year periods of non-overlapping data. That is, rather than my rolling betas they looked at periods

[13] This is also accepted in the literature. Gombola and Kahl, "Time series properties of utility betas," Financial Management, 1990, come to the same conclusion.

[14] Michelfielder and Theodossiou, Public Utility beta adjustment and biased costs of capital in public utility rate proceedings," The Electricity Journal, 2013, pp 60-68.

where no monthly return was used twice. They then estimated a Blume type regression model of the estimated beta against the previous period's beta and concluded

> ***"The diagnostic statistics strongly refute the validity of the Blume equation for public utility stocks. Most of the R^2s are equal or very close to 0.00 and the largest is 0.09. Only one F statistic is significant and all but two slopes are insignificant….None of the 51 beta distributions display any tendency for the betas to drift toward one"***

All the significance in these regressions came from the constant; the prior period beta estimate had no predictive power for the future beta regardless of whether the betas were estimated over 5, 7, 8 or 9 years of data.

The work of Michelfielder and Theodossiou is similar to work that myself and my late colleague Professor Michael Berkowitz entered into evidence in a TransCanada hearing in 2001. At that time, we had 16 holding companies of utilities, pipelines, and telephone companies (Telcos) in Canada that were regulated on a rate of return basis. We first estimated their betas in the normal way with the reported values in Schedule 8; then we regressed the 2000 betas estimated for the period 1995-2000 against their 1995 betas estimated over the period 1991-1995. This is an almost identical procedure to that used by Blume and gave the following results.

$$\beta_T = 0.947 - 0.822\beta_{T-5}$$

Setting the two betas equal implied that their equilibrium beta was 0.52 that is, 0.947/(1+.822)).

Unfortunately, a quick look at the companies in Schedule 8 reveals that the sample is much reduced: the Telcos are no longer rate of return regulated, while most of the pipelines and utilities have disappeared or substantially changed. However, I have long judged the equilibrium utility beta to be about 0.50, partly based on this early work and partly on the estimates in Schedule 1 adjusted for the impact of interest rate risk.[15]

The work of Gombola and Kahl and Michelfielder and Theodossiou is the only published research that I am aware of that specifically looks at the adjustment tendency of utility betas. It is

[15] A regression of the estimated beta against the estimated gamma coefficient for the utility index indicates a beta estimate with a neutral interest rate forecast of approximately 0.46.

almost a truism that across all stocks there should be a tendency to revert toward 1.0 since this is the average of all stocks. However, this does not mean that this process holds for subsets of stocks that are perennially either low or high risk. A utility with an actual beta of say 0.80 in one period is much more likely to have a beta closer to 0.50 next period than a Blume adjusted beta of 0.87. However, rather than any mechanical weighting I generally prefer to use judgment constrained by the actual historic evidence of the low risk nature of utility holding companies and their long run value of about 0.50.

Frequency of beta estimation

Another issue is the frequency with which betas are estimated. The standard in academic work is to estimate them over 5 years of *monthly* data. For example, the standard data base used by US academics (Centre for Research in Security prices or CRSP) traditionally only had monthly data. More recently, it has added daily data which is used for certain types of analysis such as an "event study" where we look at the impact of, for example, a dividend announcement. However, it is well known that betas are biased when estimated over high frequencies such as using weekly data. The reason for this is that many stocks do not trade that actively, so their prices are a bit "stale" and do not reflect recent events. Consequently, their betas are downward biased since the prices do not "move". There are "thin trading" adjustments for this, but since the average of all betas is 1.0, thickly traded betas in comparison are biased high. In other words, as the estimation frequency becomes shorter the betas for larger firms get larger while those for smaller firms get smaller.

Hawawini[16] looked at this problem and concluded

> "This suggests that betas measured over return intervals of arbitrary length will tend to be biased. In particular, securities with relatively small market values may appear to be less risky than they truly are, whereas securities with relatively large market values may appear to be more risky than they truly are."

[16] Gabriel Hawawini, "why beta shifts as the return interval changes," Financial Analysts Journal, (May-June 1983).

What this means is that I don't accept betas that are first estimated over short periods of time, such as weekly observations, and then adjusted to 1.0 using the Blume adjustment. As is well known both these procedures will bias the beta estimate for utilities upwards.

Public market beta estimates

From the prior discussion, betas can be estimated over a variety of time horizons; 5 years of monthly data is the norm, but Michelfielder and Theodossiou, for example, used 5, 7, 8, and 9 years of monthly data. We would therefore not expect all beta estimates from different sources to be the same; this requires that everyone use the same estimation window which is highly unlikely. To look at the range of estimates I collected the following beta estimates as reported by independent organisations CFRA, Reuters, Yahoo, and the Royal Bank of Canada on January 28, 2022, as well my own estimates with data up to December 2021.

		Mkt Value $CDN Billions	RBC	Yahoo	CFRA	Reuters	Booth
TransCanada	TRP	64.5	0.73	0.79	0.79	0.64	0.76
Enbridge	ENB	107.6	0.9	0.94	0.94	0.55	0.97
Canadian Utilities	CU	9.8	0.56	0.56	0.56	0.24	0.58
Emera	EMA	15.8	0.27	0.25	0.25	0.06	0.28
Fortis	FTS	28.3	0.1	0.09	0.08	0.31	0.11
Pembina	PPL	21.9	1.68		1.72	0.73	1.73
Average		41.32	0.71	0.53	0.72	0.42	0.74
Median		25.10	0.65	0.56	0.68	0.43	0.67

Note the Reuters report estimates the beta for some of these Canadian companies (highlighted in yellow) using the US stock market as the benchmark, which is why they appear to be lower.

For the pipeline sample my average beta estimate is 1.15 whereas the average for these independent services is 0.98 and biased low due to Reuters use of the US stock market as the benchmark. The differences across services are relatively minor and I suspect they are largely due to the time-period over which the betas are estimated and whether they capture good or bad news on approvals for pipeline expansions. For the three Canadian UHCs my average beta is 0.32 whereas the average from the four services is 0.28. This indicates the continued low risk

nature of Canadian UHCs, since the highest beta is the 0.56 for CU.[17] It also indicates that these services do not adjust their beta estimates using the Blume methodology, since with an actual beta of 0 the Blume adjustment would give a beta of 0.33 and the average beta for these UHCs is less than that.

For the U.S. gas companies their beta estimates are below. The average from the four services is 0.44 the same as my own estimate even though individual estimates differ. Interestingly, the highest beta estimate is from RBC for One Gas at 0.65 but otherwise these estimates are remarkably similar.

	Mkt Value	US Gas Companies					
	US$Billion	CFRA	Reuters	RBC	Yahoo	Average	Booth
Spire (SR)	3.40	0.35	0.37	0.32	0.35	0.35	0.31
One Gas (OGS)	6.90	0.55	0.45	0.65	0.55	0.55	0.51
NorthWest (NWN)	1.46	0.51	0.19	0.49	0.51	0.43	0.56
New Jersey (NJR)	3.83	0.61	0.53	0.58	0.61	0.58	0.57
Atmos (ATO)	14.08	0.50	0.28	0.45	0.50	0.43	0.46
SouthWest (SWX)	4.08	0.23	0.50	0.23	0.22	0.30	0.22
Average		0.46	0.39	0.45	0.46	0.44	0.44

It is also of importance that the way these estimates are derived appears to be consistent with conventional practise. One of the biggest data providers in Canada is the Financial Post, where their Corporate Analyzer data base includes ten year financial data for larger publicly listed Canadian companies. Their definition of beta is:

Beta (Corporate Profiles)

Beta factors are derived from a historical regression of percentage share price changes for the selected company on percentage changes in the TSE 300 price index. The unadjusted slope coefficient from this regression is the beta factor. Beta factors may be computed on a variety of weekly or monthly data. Betas shown in FP Analyzer are for 52 weeks, 36 months, 60 months and 120 months.

Again there is no discussion of "adjusting" betas using the Blume procedure, in fact they very specifically state the "unadjusted slope coefficient" which is what the beta estimate is. However, the Financial Post does note that different time horizons can be used other than my conventional use of five years of data.

[17] The Yahoo beta estimates with pertinent financial data for the Canadian UHCs are in Appendix A.

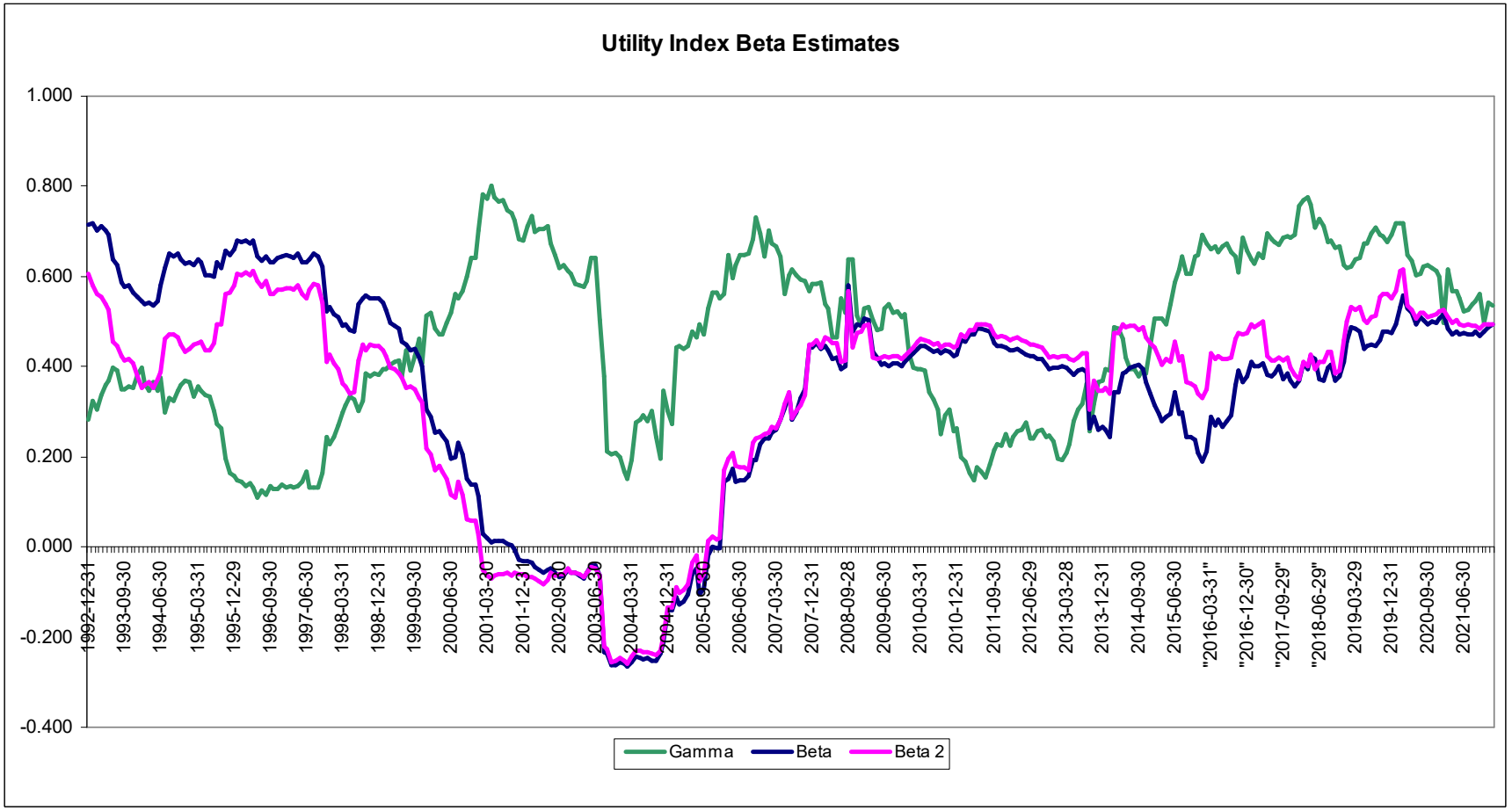
Conclusion

What is clear from the above analysis is that the market recognises that Canadian utilities are significantly lower than average risk. This comes through after:

- I recognise that the low values during the internet bubble period were an anomaly
- I analyse the utility sub index versus individual Canadian firms
- I check the Canadian estimates against a sample of U.S. gas companies.
- I check the estimates against those that are publicly available from Yahoo Finance as well as those from Canada's largest bank and two independent, research services.
- I recognise that beta coefficients tend to vary inversely with interest rate risk and the return to the long Canada bond.

From this analysis, I have generally set the generic risk assessment for a Canadian utility in a beta range of 0.45-0.55. The high end of this range is approximately the recent beta for the "purest" Canadian utility which is Canadian Utilities, and the low end a generous estimate based on the impact of the return on the long Canada bond on beta estimates for the TSX utility index. Given the marginal increases in the beats I would therefore tend to be conservative and increase the range to 0.50-0.55 with a mid-point of 0.525 which has historically been about the grand mean of the utility betas.

SCHEDULE 1


Utility Index Beta Estimates
1.000
0.800
0.600
0.400
0.200
0.000
-0.200
-0.400
1992-12-31
1993-09-30
1994-06-30
1995-03-31
1995-12-29
1996-09-30
1997-06-30
1998-03-31
1998-12-31
1999-09-30
2000-06-30
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2013-12-31
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2015-06-30
"2016-03-31"
"2016-12-30"
"2017-09-29"
"2018-06-29"
2019-03-29
2019-12-31
2020-09-30
2021-06-30
Gamma
Beta
Beta 2

Regression Statistics	
Multiple R	0.471
R Square	0.222
Adjusted R Square	0.218
Standard Error	3.222
Observations	409

overall period

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	2	1201.328	600.664	57.848	0.000
Residual	406	4215.673	10.383		
Total	408	5417.000			

	Coefficients	*tandard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	0.244	0.162	1.504	0.133	-0.075	0.562	-0.075	0.562
TSX	0.301	0.040	7.563	0.000	0.223	0.379	0.223	0.379
LTC Bond return	0.455	0.067	6.802	0.000	0.323	0.586	0.323	0.586

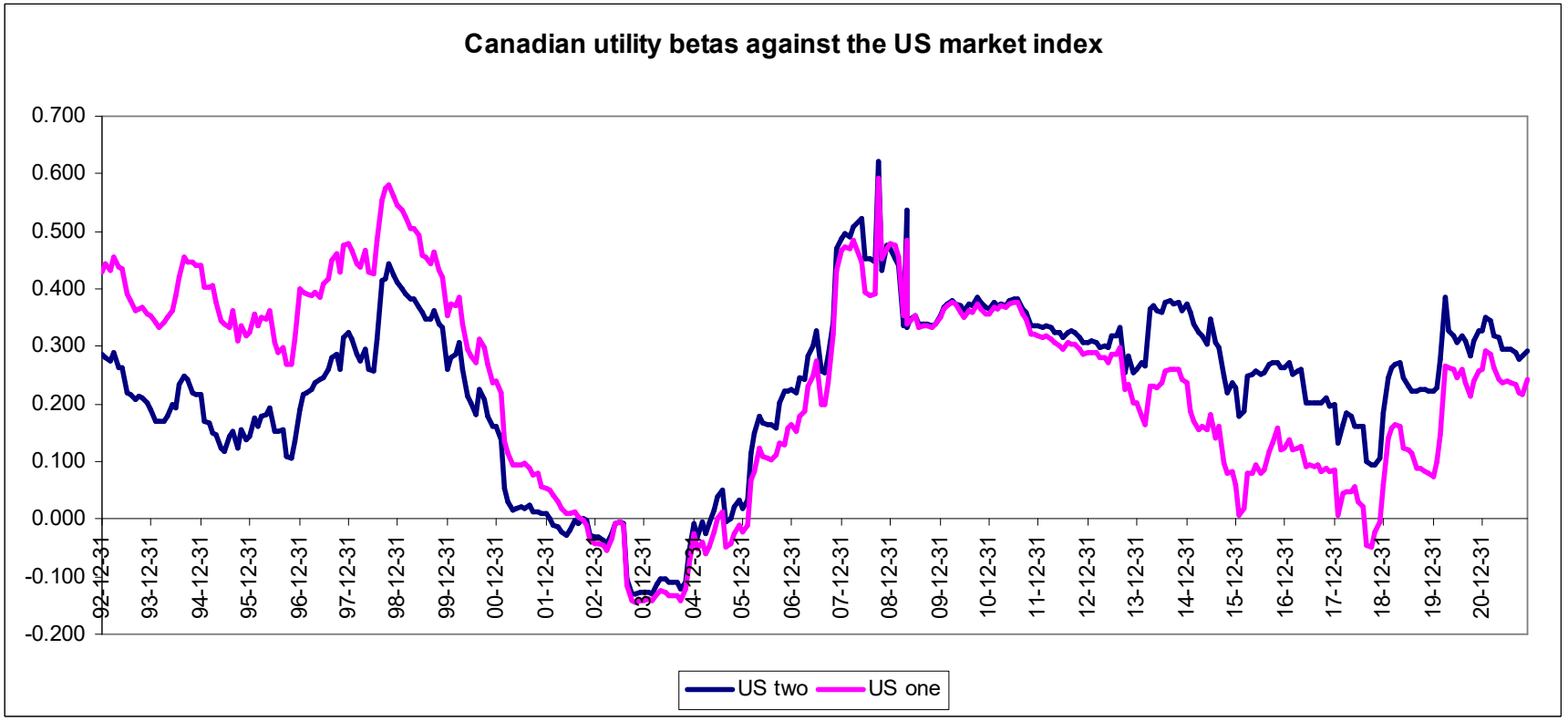
Regression Statistics	
Multiple R	0.716
R Square	0.513
Adjusted R Square	0.496
Standard Error	2.392
Observations	60

2017- 2022

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	2	343.813	171.907	30.055	0.000
Residual	57	326.025	5.720		
Total	59	669.838			

	Coefficients	*tandard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	0.423	0.315	1.343	0.184	-0.207	1.053	-0.207	1.053
TSX	0.494	0.077	6.403	0.000	0.339	0.648	0.339	0.648
LTC Bond return	0.537	0.124	4.347	0.000	0.290	0.784	0.290	0.784


Canadian utility betas against the US market index
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
92-12-31
93-12-31
94-12-31
95-12-31
96-12-31
97-12-31
98-12-31
99-12-31
00-12-31
01-12-31
02-12-31
03-12-31
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11-12-31
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13-12-31
14-12-31
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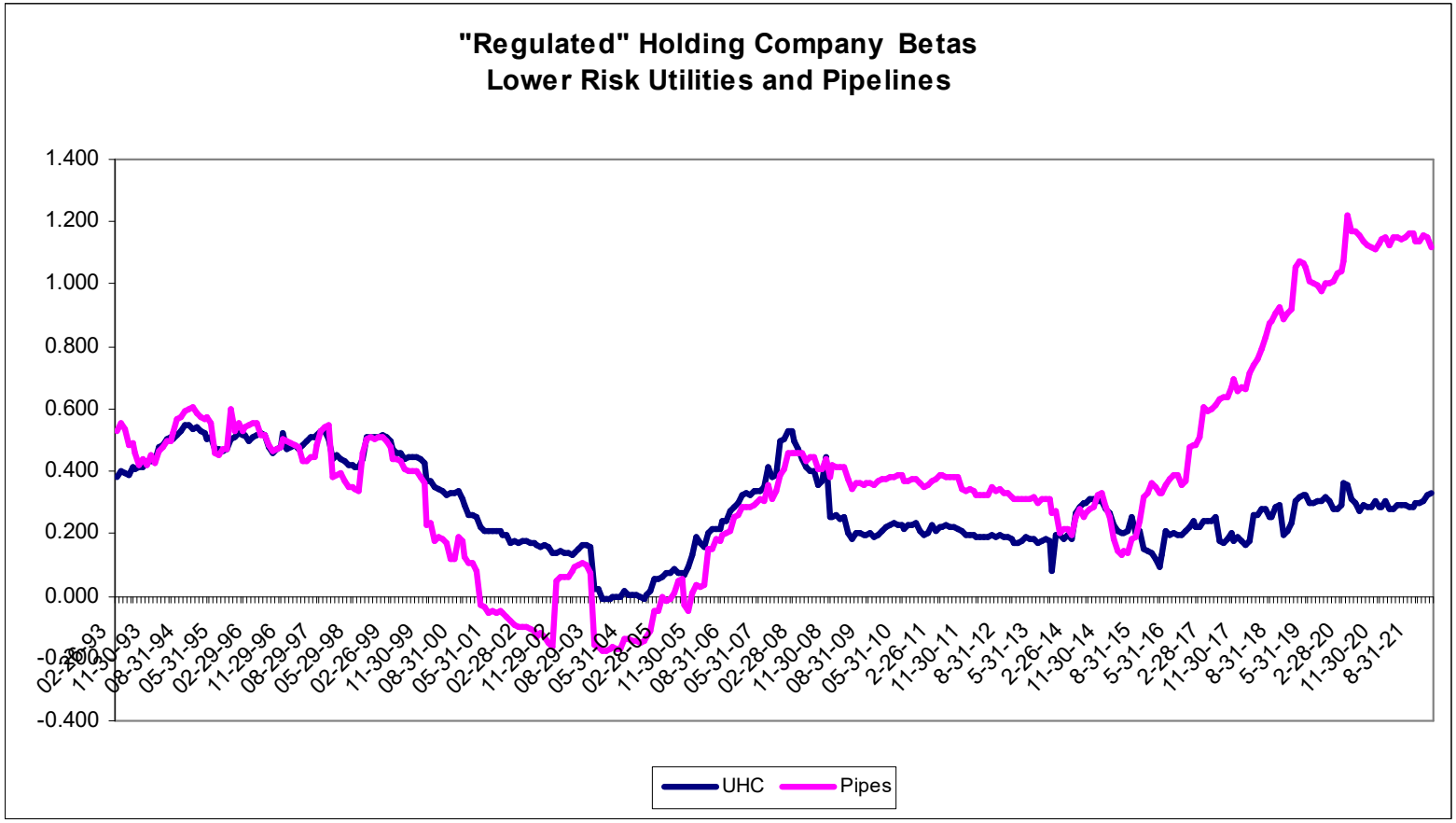
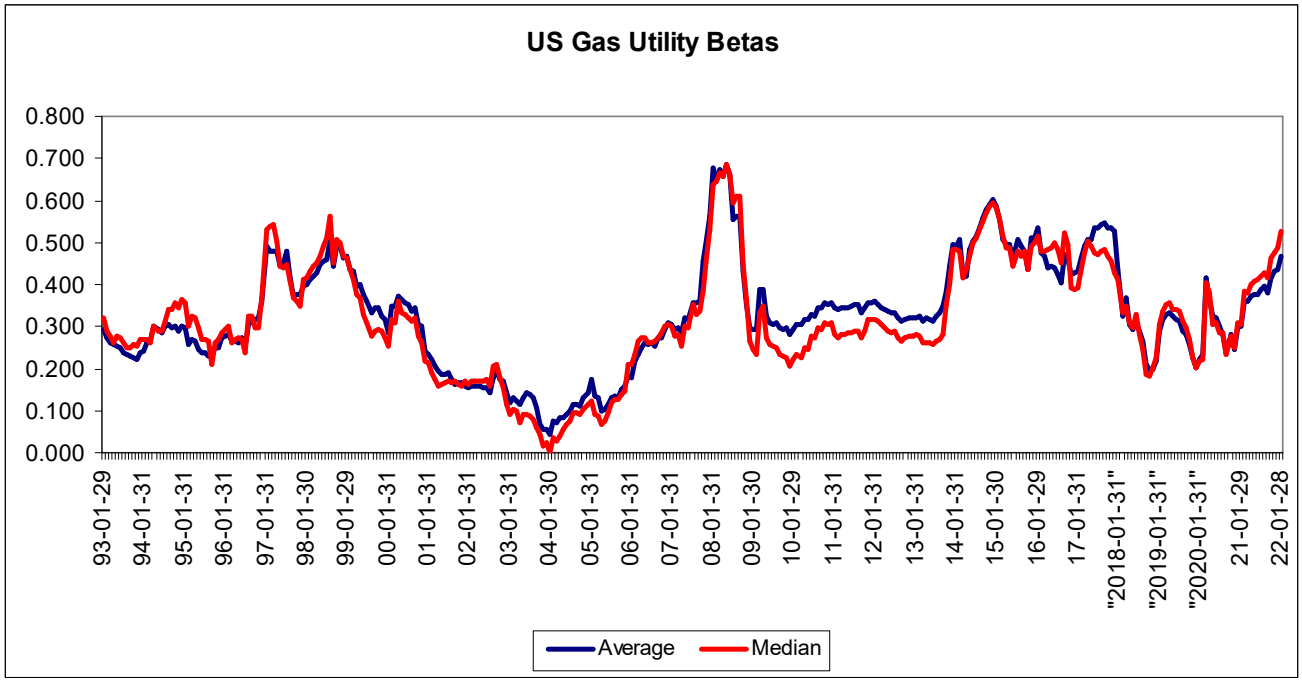
18-12-31
19-12-31
20-12-31
US two
US one


"Regulated" Holding Company Betas
Lower Risk Utilities and Pipelines
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
-0.400
11-30-93
08-31-94
05-31-95
02-29-96
11-29-96
08-29-97
05-29-98
02-26-99
11-30-99
08-31-00
05-31-01
02-28-02
11-29-02
08-29-03
05-31-04
02-28-05
11-30-05
08-31-06
05-31-07
02-28-08
11-30-08
08-31-09
05-31-10
2-26-11
11-30-11
8-31-12
5-31-13
2-26-14
11-30-14
8-31-15
5-31-16
2-28-17
11-30-17
8-31-18
5-31-19
2-28-20
11-30-20
8-31-21
UHC
Pipes

			Canadian Utility Holding Companies (UHCs) and Pipelines							
	CUL	Emera	Fortis	GMI	UHCs	Enbridge	TRP	VERESEN	PPL	Pipelines
12-29-00	0.36	0.28	0.22	0.18	0.26	0.05	0.17			0.11
12-31-01	0.25	0.21	0.13	0.10	0.17	-0.13	-0.07			-0.10
12-31-02	0.18	0.16	0.13	0.07	0.14	-0.20	-0.08		0.46	0.06
12-31-03	0.05	-0.05	-0.05	0.02	-0.01	-0.40	-0.40	0.02	0.11	-0.17
12-31-04	0.03	-0.02	0.03	0.16	0.05	-0.32	-0.19	0.10	0.21	-0.05
12-30-05	0.21	0.05	0.23	0.19	0.17	-0.18	-0.19	0.19	0.29	0.03
12-29-06	0.33	0.09	0.48	0.42	0.33	0.22	0.30	0.33	0.30	0.29
12-31-07	0.53	0.21	0.61	0.75	0.53	0.52	0.48	0.33	0.50	0.46
12-31-08	0.18	0.14	0.20	0.51	0.26	0.32	0.37	0.51	0.45	0.41
12-31-09	0.09	0.16	0.20	0.38	0.21	0.32	0.40	0.44	0.33	0.37
12-31-10	0.09	0.22	0.16	0.35	0.20	0.34	0.40	0.37	0.30	0.35
12-31-11	0.06	0.21	0.15	0.36	0.19	0.32	0.37	0.35	0.32	0.34
12-31-12	0.01	0.23	0.13	0.32	0.17	0.22	0.33	0.40	0.29	0.31
12-31-13	0.03	0.25	0.28	0.18	0.18	0.19	0.33	0.22	0.12	0.21
12-31-14	0.20	0.32	0.26	0.27	0.26	0.11	0.28	0.34	0.29	0.25
12-31-15	0.10	0.08	0.06	0.23	0.12	0.26	0.33		0.46	0.35
12-31-16	0.47	0.09	0.00	0.25	0.20	0.41	0.47		0.64	0.51
12-31-17	0.49	0.00	0.01	0.15	0.16	0.62	0.57		0.79	0.66
12-31-18	0.40	0.14	0.05	0.34	0.23	0.79	0.86		1.11	0.92
12-31-19	0.46	0.29	0.07		0.28	0.97	1.02		1.11	1.03
12-31-20	0.55	0.24	0.07		0.29	0.95	0.72		1.76	1.14
12-31-21	0.58	0.28	0.11		0.32	0.97	0.76		1.73	1.15
	Pembina Pipeline (PPL) doubled its market value by buying Versen in 2017 for $9.7 billion									
	Since September 27 2019 Valener (GMI) is a privately owned private subsidary of Noverco									


US Gas Utility Betas
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
93-01-29
94-01-31
95-01-31
96-01-31
97-01-31
98-01-30
99-01-29
00-01-31
01-01-31
02-01-31
03-01-31
04-01-30
05-01-31
06-01-31
07-01-31
08-01-31
09-01-30
10-01-29
11-01-31
12-01-31
13-01-31
14-01-31
15-01-30
16-01-29
17-01-31
"2018-01-31"
"2019-01-31"
"2020-01-31"
21-01-29
22-01-28
Average
Median

US Gas Company Betas

	NWN	NJR	SR	ATO	SWX	OGS	Average	Median
00-12-29	0.12	0.36	0.21	-0.02	0.61		0.25	0.21
01-12-31	0.08	0.24	0.05	-0.18	0.54		0.14	0.08
02-10-31	0.01	0.16	0.04	-0.01	0.57		0.15	0.04
03-12-31	-0.21	0.03	0.01	-0.01	0.19		0.00	0.01
04-12-31	-0.04	0.09	0.13	0.01	0.28		0.09	0.09
05-12-30	0.06	-0.04	0.15	0.19	0.26		0.12	0.15
06-12-29	0.14	0.03	0.49	0.45	0.23		0.27	0.23
07-12-31	0.60	0.44	0.79	0.72	0.42		0.59	0.60
08-12-31	0.36	0.14	0.10	0.50	0.63		0.35	0.36
09-12-31	0.24	0.12	0.01	0.49	0.70		0.31	0.24
10-12-31	0.35	0.22	0.08	0.51	0.73		0.38	0.35
11-12-30	0.32	0.25	0.06	0.50	0.72		0.37	0.32
12-12-31	0.26	0.23	0.07	0.44	0.69		0.34	0.26
13-12-31	0.39	0.44	0.32	0.54	0.73		0.49	0.44
14-12-31	0.57	0.62	0.45	0.57	0.73		0.59	0.57
15-12-31	0.31	0.53	0.37	0.43	0.59		0.45	0.43
16-12-30	0.31	0.39	0.35	0.27	0.47		0.36	0.35
17-12-29	0.40	0.43	0.31	0.41	0.62		0.44	0.41
18-12-31	0.29	0.23	0.05	0.12	0.41		0.22	0.23
19-12-31	0.23	0.31	0.11	0.14	0.17	0.24	0.20	0.17
20-12-31	0.44	0.41	0.18	0.30	0.13	0.32	0.30	0.30
21-12-31	0.56	0.57	0.31	0.46	0.22	0.51	0.44	0.46

SCHEDULE 8

ROLLING BETAS

FIRM	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
BCE INC	0.368	0.370	0.357	0.480	0.432	0.520	0.477	0.608	0.630	0.989	1.240	1.002
BCT TEL	0.29	0.328	0.349	0.548	0.642	0.812	0.739	0.731	0.757	0.975	0.900	1.013
QUEBEC TEL	0.351	0.269	0.250	0.296	0.211	0.552	0.421	0.616	0.572	0.88	0.721	0.892
NEWTEL	0.417	0.375	0.405	0.559	0.470	0.569	0.568	0.585	0.348	0.539	0.438	0.474
BRUNCOR	0.38	0.400	0.412	0.545	0.432	0.577	0.336	0.377	0.427	0.775	0.758	0.781
MARITIME TT	0.367	0.402	0.332	0.359	0.263	0.376	0.274	0.357	0.603	0.785	0.780	0.818
ISLAND TEL	0.26	0.250	0.249	0.189	0.216	0.534	0.441	0.591	0.524	0.71	0.603	0.606
MEAN TELCOS	**0.348**	**0.342**	**0.336**	**0.425**	**0.381**	**0.563**	**0.465**	**0.552**	**0.552**	**0.808**	**0.777**	**0.798**
MARITIME ELEC	0.383	0.405	0.396	0.536	0.672	0.321	n/a	n/a	N/a	n/a	n/a	n/a
TRANSALTA	0.233	0.284	0.271	0.377	0.451	0.491	0.588	0.585	0.462	0.536	0.285	0.259
FORTIS	0.280	0.230	0.271	0.402	0.377	0.563	0.537	0.390	0.310	0.484	0.320	0.216
CDN UTIL	0.418	0.413	0.382	0.456	0.475	0.466	0.501	0.561	0.634	0.616	0.530	0.361
BC GAS	0.528	0.522	0.493	0.425	0.444	0.570	0.627	0.562	0.474	0.479	0.338	0.231
MEAN GAS/ELEC	**0.368**	**0.371**	**0.363**	**0.439**	**0.484**	**0.482**	**0.563**	**0.525**	**0.470**	**0.529**	**0.368**	**0.267**
PAC N GAS	0.362	0.449	0.478	0.404	0.543	0.305	0.492	0.286	0.443	0.573	0.492	0.453
TRANSCDA P	0.657	0.616	0.550	0.492	0.385	0.549	0.538	0.489	0.338	0.544	0.238	0.182
TRANS MNT	0.757	0.662	0.665	0.796	0.588	0.525	n/a	n/a	N/a	n/a	n/a	n/a
WESTCOAST	0.723	0.683	0.667	0.522	0.550	0.562	0.557	0.611	0.531	0.453	0.261	0.134
MEAN PIPELINES	**0.625**	**0.603**	**0.590**	**0.554**	**0.517**	**0.485**	**0.529**	**0.462**	**0.437**	**0.523**	**0.330**	**0.256**
MEAN OVERALL	**0.424**	**0.416**	**0.408**	**0.462**	**0.447**	**0.518**	**0.507**	**0.525**	**0.504**	**0.667**	**0.565**	**0.530**

Taken from Schedule B2 of L. Booth and M. Berkowitz before the National Energy Board
December 2001

Appendix A Yahoo Beta estimates and financial data for Canadian UHCs

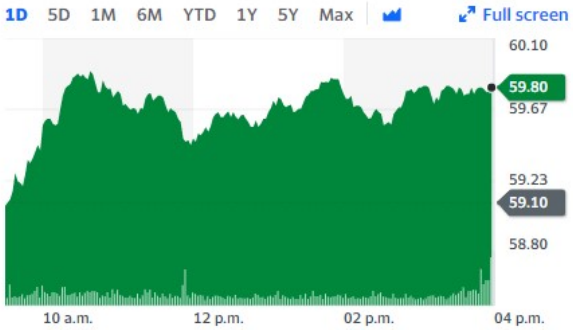
Fortis Inc. (FTS.TO)
Toronto - Toronto Real Time Price. Currency in CAD

Add to watchlist

59.80 +0.70 (+1.18%)
At close: January 28 03:59PM EST

Summary | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | Holders | Sustainability

Previous Close	59.10	Market Cap	28.279B
Open	59.08	Beta (5Y Monthly)	0.09
Bid	59.79 x 0	PE Ratio (TTM)	22.75
Ask	59.81 x 0	EPS (TTM)	2.63
Day's Range	58.93 - 59.92	Earnings Date	Feb. 11, 2022
52 Week Range	48.97 - 61.54	Forward Dividend & Yield	2.14 (3.58%)
Volume	1,260,148	Ex-Dividend Date	Feb. 14, 2022
Avg. Volume	1,569,916	1y Target Est	59.61



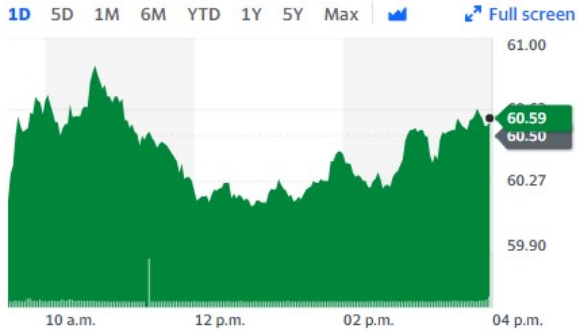
Emera Incorporated (EMA.TO)
Toronto - Toronto Real Time Price. Currency in CAD

Add to watchlist

60.52 +0.02 (+0.03%)
At close: January 28 03:59PM EST

Summary | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | Holders | Sustainability

Previous Close	60.50	Market Cap	15.653B
Open	60.45	Beta (5Y Monthly)	0.25
Bid	60.43 x 0	PE Ratio (TTM)	33.64
Ask	60.47 x 0	EPS (TTM)	1.80
Day's Range	60.05 - 60.89	Earnings Date	Feb. 14, 2022
52 Week Range	49.66 - 63.71	Forward Dividend & Yield	2.65 (4.38%)
Volume	926,435	Ex-Dividend Date	Jan. 31, 2022
Avg. Volume	928,163	1y Target Est	62.90



Canadian Utilities Limited (CU.TO)

Toronto - Toronto Real Time Price. Currency in CAD

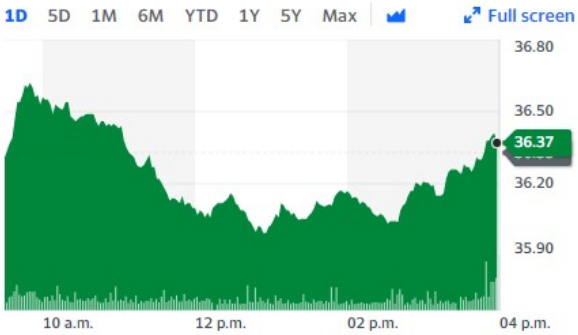
Add to watchlist

36.39 +0.06 (+0.17%)

At close: January 28 03:59PM EST

Summary | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | Holders | Sustainability

Previous Close	36.33	Market Cap	9.793B
Open	36.44	Beta (5Y Monthly)	0.56
Bid	36.36 x 0	PE Ratio (TTM)	38.67
Ask	36.38 x 0	EPS (TTM)	0.94
Day's Range	35.99 - 36.64	Earnings Date	Feb. 23, 2022 - Feb. 28, 2022
52 Week Range	29.96 - 37.00	Forward Dividend & Yield	1.78 (4.88%)
Volume	614,807	Ex-Dividend Date	Feb. 02, 2022
Avg. Volume	492,157	1y Target Est	37.72



TC Energy Corporation (TRP.TO)

Toronto - Toronto Real Time Price. Currency in CAD

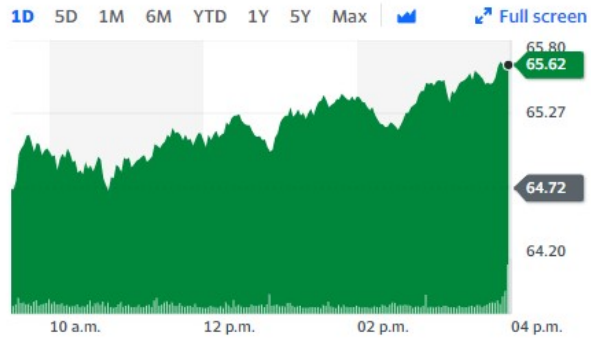
Add to watchlist

65.61 +0.89 (+1.38%)

At close: January 28 03:59PM EST

Summary | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | Holders | Sustainability

Previous Close	64.72	Market Cap	64.363B
Open	64.72	Beta (5Y Monthly)	0.79
Bid	65.61 x N/A	PE Ratio (TTM)	34.71
Ask	65.58 x N/A	EPS (TTM)	1.89
Day's Range	64.51 - 65.65	Earnings Date	Feb. 15, 2022
52 Week Range	53.20 - 68.20	Forward Dividend & Yield	3.48 (5.38%)
Volume	4,668,175	Ex-Dividend Date	Dec. 30, 2021
Avg. Volume	4,380,362	1y Target Est	67.31



Enbridge Inc. (ENB.TO)

Toronto - Toronto Real Time Price. Currency in CAD

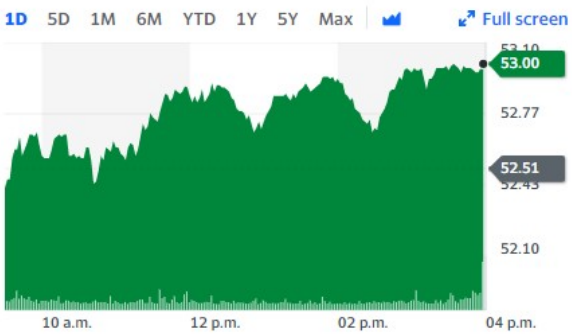
Add to watchlist

53.00 +0.49 (+0.93%)

At close: January 28 03:59PM EST

Summary | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | Holders | Sustainability

Previous Close	52.51	Market Cap	107.383B
Open	52.43	Beta (5Y Monthly)	0.94
Bid	52.99 x 0	PE Ratio (TTM)	18.66
Ask	53.00 x 0	EPS (TTM)	2.84
Day's Range	52.25 - 53.00	Earnings Date	Feb. 11, 2022
52 Week Range	42.93 - 54.00	Forward Dividend & Yield	3.44 (6.49%)
Volume	4,640,096	Ex-Dividend Date	Feb. 14, 2022
Avg. Volume	9,742,988	1y Target Est	55.36



Pembina Pipeline Corporation (PPL.TO)

Toronto - Toronto Real Time Price. Currency in CAD

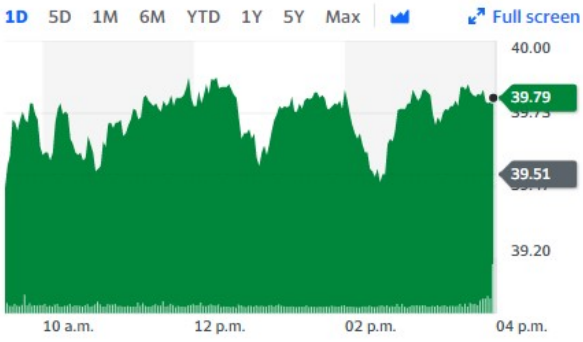
Add to watchlist

39.82 +0.31 (+0.78%)

At close: January 28 03:59PM EST

Summary | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | Holders | Sustainability

Previous Close	39.51	Market Cap	21.915B
Open	39.55	Beta (5Y Monthly)	1.72
Bid	39.79 x 0	PE Ratio (TTM)	N/A
Ask	39.77 x 0	EPS (TTM)	-0.37
Day's Range	39.31 - 39.88	Earnings Date	Feb. 24, 2022
52 Week Range	32.30 - 43.00	Forward Dividend & Yield	2.52 (6.38%)
Volume	1,738,968	Ex-Dividend Date	Jan. 24, 2022
Avg. Volume	2,135,393	1y Target Est	44.09



Appendix B. Yahoo Beta estimates and financial data for US Gas companies

Southwest Gas Holdings, Inc. (SWX)
NYSE - NYSE Delayed Price. Currency in USD

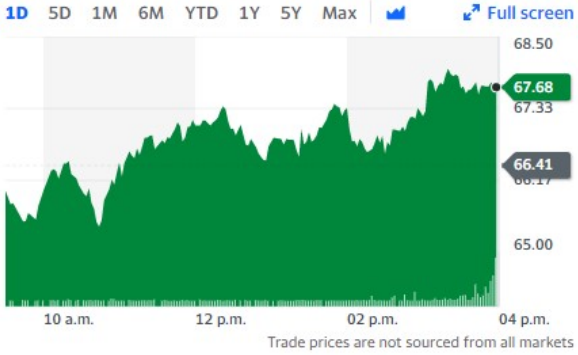
Add to watchlist

67.65 +1.24 (+1.87%)
At close: January 28 03:59PM EST

67.65 0.00 (0.00%)
After hours: 04:42PM EST

Summary | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | Holders | Sustainability

Previous Close	66.41	Market Cap	4.085B
Open	66.00	Beta (5Y Monthly)	0.22
Bid	67.68 x 800	PE Ratio (TTM)	16.83
Ask	68.99 x 1100	EPS (TTM)	4.02
Day's Range	65.42 - 67.99	Earnings Date	Feb. 23, 2022 - Feb. 28, 2022
52 Week Range	58.91 - 73.54	Forward Dividend & Yield	2.38 (3.58%)
Volume	605,575	Ex-Dividend Date	Feb. 14, 2022
Avg. Volume	324,122	1y Target Est	75.50



Spire Inc. (SR)
NYSE - Nasdaq Real Time Price. Currency in USD

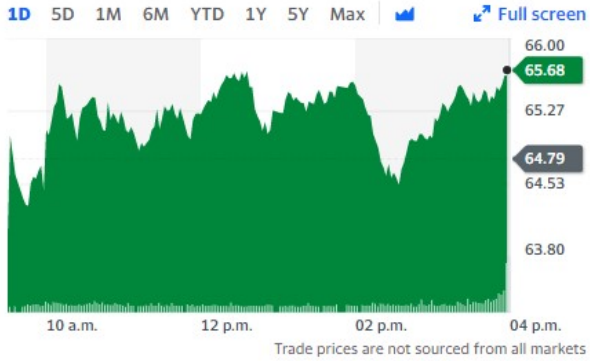
Add to watchlist

65.68 +0.89 (+1.37%)
At close: January 28 03:59PM EST

65.82 +0.14 (+0.21%)
After hours: 04:28PM EST

Summary | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | Holders | Sustainabili

Previous Close	64.79	Market Cap	3.398B
Open	64.43	Beta (5Y Monthly)	0.35
Bid	65.48 x 900	PE Ratio (TTM)	13.24
Ask	65.82 x 800	EPS (TTM)	4.96
Day's Range	64.02 - 65.75	Earnings Date	Feb. 02, 2022
52 Week Range	59.60 - 77.95	Forward Dividend & Yield	2.74 (4.17%)
Volume	318,616	Ex-Dividend Date	Dec. 09, 2021
Avg. Volume	328,732	1y Target Est	68.63



Northwest Natural Holding Company (NWN)

NYSE - Nasdaq Real Time Price. Currency in USD

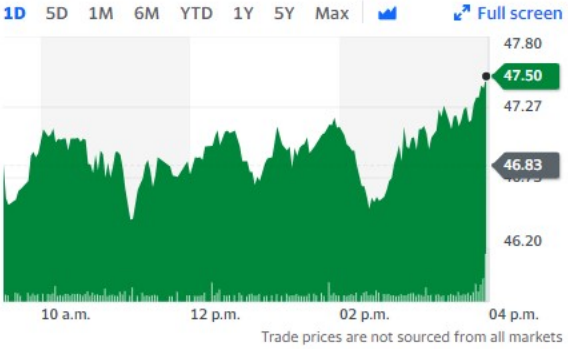
Add to watchlist

47.51 +0.68 (+1.46%) At close: January 28 03:59PM EST

48.62 +1.11 (+2.34%) After hours: 04:18PM EST

Summary | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | Holders | Sustainability

Previous Close	46.83	Market Cap	1.46B
Open	46.83	Beta (5Y Monthly)	0.51
Bid	46.19 x 800	PE Ratio (TTM)	16.17
Ask	47.23 x 1000	EPS (TTM)	2.94
Day's Range	46.42 - 47.54	Earnings Date	Feb. 25, 2022
52 Week Range	43.07 - 56.75	Forward Dividend & Yield	1.93 (4.08%)
Volume	196,916	Ex-Dividend Date	Jan. 28, 2022
Avg. Volume	180,265	1y Target Est	54.71



Trade prices are not sourced from all markets

New Jersey Resources Corporation (NJR)

NYSE - Nasdaq Real Time Price. Currency in USD

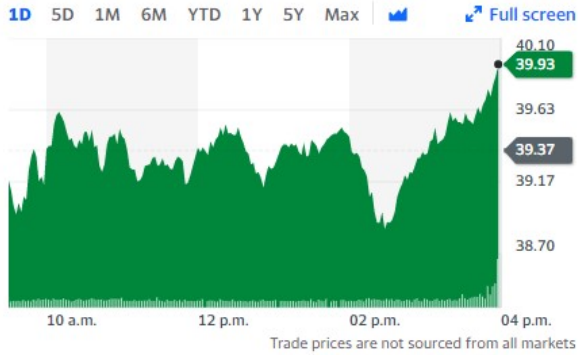
Add to watchlist

39.92 +0.55 (+1.40%) At close: January 28 03:59PM EST

39.37 -0.55 (-1.38%) After hours: 04:31PM EST

Summary | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | Holders | Sustainability

Previous Close	39.37	Market Cap	3.831B
Open	39.22	Beta (5Y Monthly)	0.61
Bid	39.66 x 1000	PE Ratio (TTM)	32.72
Ask	40.80 x 900	EPS (TTM)	1.22
Day's Range	38.85 - 39.95	Earnings Date	Feb. 03, 2022
52 Week Range	34.41 - 44.41	Forward Dividend & Yield	1.45 (3.68%)
Volume	610,416	Ex-Dividend Date	Mar. 15, 2022
Avg. Volume	418,634	1y Target Est	43.33



Trade prices are not sourced from all markets

Atmos Energy Corporation (ATO)
NYSE - Nasdaq Real Time Price. Currency in USD

Add to watchlist

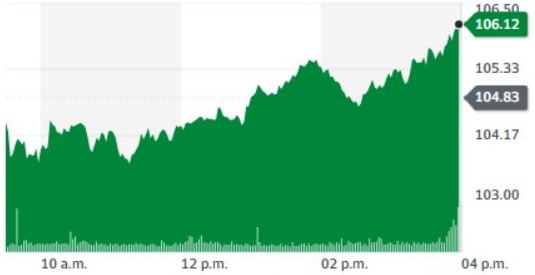
106.11 +1.28 (+1.22%)
At close: January 28 03:59PM EST

106.11 0.00 (0.00%)
After hours: 04:56PM EST

Summary | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | Holders | Sustainability

Previous Close	104.83	Market Cap	14.081B
Open	104.57	Beta (5Y Monthly)	0.50
Bid	105.98 x 800	PE Ratio (TTM)	20.72
Ask	105.55 x 800	EPS (TTM)	5.12
Day's Range	103.58 - 106.16	Earnings Date	Feb. 08, 2022
52 Week Range	84.59 - 107.66	Forward Dividend & Yield	2.72 (2.56%)
Volume	1,271,633	Ex-Dividend Date	Nov. 26, 2021
Avg. Volume	1,138,734	1y Target Est	110.71

1D 5D 1M 6M YTD 1Y 5Y Max | Full screen



Trade prices are not sourced from all markets

ONE Gas, Inc. (OGS)
NYSE - NYSE Delayed Price. Currency in USD

Add to watchlist

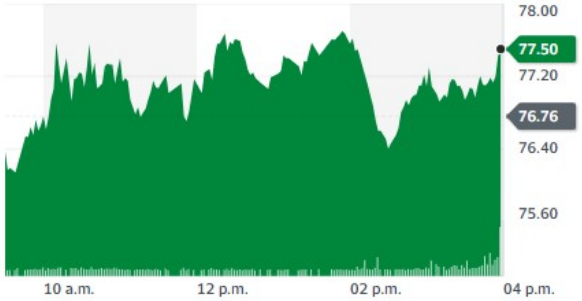
77.50 +0.74 (+0.96%)
At close: January 28 03:59PM EST

77.50 -0.01 (-0.01%)
After hours: 04:01PM EST

Summary | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | Holders | Sustainability

Previous Close	76.76	Market Cap	4.153B
Open	76.37	Beta (5Y Monthly)	0.55
Bid	77.11 x 900	PE Ratio (TTM)	20.35
Ask	77.24 x 1400	EPS (TTM)	3.81
Day's Range	75.98 - 77.72	Earnings Date	Feb. 23, 2022
52 Week Range	62.52 - 81.90	Forward Dividend & Yield	2.48 (3.23%)
Volume	285,959	Ex-Dividend Date	Feb. 24, 2022
Avg. Volume	285,093	1y Target Est	79.14

1D 5D 1M 6M YTD 1Y 5Y Max | Full screen



Trade prices are not sourced from all markets