APPENDIX B
ESTIMATION OF THE MARKET RISK PREMIUM

Introduction

In this Appendix, I estimate the market risk premium which is generally expressed as the premium of the return on equities over that on long term Canada bonds.[1] If the underlying relationship generating returns has remained reasonably constant then the historic realised difference between equity and bond returns is a useful benchmark for the market risk premium. It is the starting point for estimating the market risk premium. At the very minimum, it constrains the range of estimates that are reasonable and requires an explanation of why "this time it is different" if a recommendation significantly deviates from these historical values.

In analysing this historic data, however, we need to be aware of some estimation problems and the impact of changes that have occurred in the markets. This simply reflects the fact that every statistic is the result of specific financial and economic phenomena existing at that time.

Different Risk Premium Estimation Procedures

Suppose an investor puts $1,000 into an investment. If the investment doubles, i.e., a 100% return, to $2,000 and then halves, i.e., a -50% return, to $1,000, we can calculate two average or mean rates of return from these two simple rates of return of +100% and -50%. The ***arithmetic*** mean (AM) would be the average of these two rates of return, or 25%. However, it would be difficult to convince an investor, who after two years only has the same $1,000 that they started with, that they have earned 25%. Quite obviously, the investor is no better off at the end of the two periods than they were at the start! To counterbalance this potentially misleading statistic, most mutual funds advertise ***compound*** rates of return, which is the nth root of the terminal value divided by the initial value, minus one. In our case, there are two periods, so that n=2 and

[1] This appendix covers similar material to that covered in Laurence Booth "Equities Over Bonds: But by How Much?" *Canadian Investment Review*, Spring 1995, and Estimating the Equity Risk Premium and Expected Equity Rates of Return: The Case of Canada, *Journal of Applied Corporate Finance* Winter 2019.

the compound rate of return is calculated as $(1/1)^{1/2}$ which is 1, indicating a zero rate of return. This gives the common-sense solution that if you started and finished with $1,000, then your rate of return is zero.

An alternative way of thinking about the compound rate of return is to calculate the continuous rate of return. This is calculated as the natural logarithm of 1 plus the rate of return. So, for the first period when the investment doubled this is Ln (1+100%) or Ln (2) which is 0.693147. Similarly, in the second period it is Ln (1-50%) or Ln (0.5) which is -.693147. The average of these two is zero which is the compound rate of return estimated earlier. We also call this rate of return the geometric mean rate of return (GM).

If we need the best estimate of *next* period's rate of return, this is the AM return. If we need the best estimate of the return over several periods, the AM return becomes less useful and more emphasis is placed on the GM return. If we want the best estimate of the rate of return earned over a very long time, this is the GM return. Moreover, if we ignore intervening periods, then the AM return is the same as the GM return. For example, if we define the period as the prior two periods then over that "two period" $1,000 has grown to $1,000 so both the AM and GM returns are 0%. As a result, the difference between the AM and GM returns is essentially the definition of the period over which a return is earned.

What causes the AM and GM to differ is the uncertainty in the simple rates of return. If these are constant, then both the AM and GM returns are identical. However, the more volatile these rates of return, the larger the difference between the AM and GM returns. There is a large amount of uncertainty (a high variance or var) in the rates of return in the example. As a result, the difference between the AM and GM returns is large: 25% vs 0%. Approximately, the relationship is as follows:

$$Compound\ rate\ of\ return = Arithmetic\ return - (var/2)$$

In estimating the market risk premium for a regulated utility, I believe that the correct time-period for calculating rates of return is a **one-**year holding period. The reason for this is primarily because most utilities are regulated based on annual rates of return.

Finally, in addition to the AM and GM rates of return I also estimate a rate of return estimated by an ***ordinary least squares*** (OLS) regression model. This is a statistical technique that estimates the annual rate of return by minimising the deviations around the estimate. It has properties that makes it a superior estimate of the average rate of return than either the AM or GM returns and is the standard technique for estimating economic models. It is commonly used, for example, for estimating other annual growth rates, such as the growth rate needed in dividend growth rate models.

Market Risk Premium Estimates Going Forward and Backwards

In Schedule 1 I graph estimates of the average market risk premium using Canadian data and these three estimation techniques.[2] In the top graph starting for the five-year period 1924-1928 the average market risk premium is estimated for each of the AM, GM and OLS methods and is then updated each year with the addition of the new data, so the second observation is for the period 1924-1929. In this way the graph captures the "learning" since 1924. The instability in the 1920s into the 1930's is evident as all the estimates start out very high due to the strong equity markets prior to the great stock market crash before declining precipitously. However, the market risk premium stabilises by the late 1950s, before beginning a long gradual *decrease to 4.97% for the entire period 1924-2021.* This is partly because the importance of the period prior to the 1960's decreases in relative importance with every passing year.

An alternative procedure is to work backwards, that is, start in the five-year period 2017-2021 and then go back in time, which is the lower graph in Schedule 1. In this way, we capture what *current* market participants have experienced, rather than what their great-grand-parents experienced. Note that whereas the previous graph always includes the period 1924-1928 with its exceptionally high experienced risk premium, this graph always includes the most recent five-year period 2017-2021 where the market risk premium was also high at 7.35%. As we work back through time, the estimate of the market risk premium drops as the importance of the recent period of high equity returns drops. By the 1980's estimates of the market risk premium for the

2 The graphs use data from the Canadian Institute of Actuaries, "Report on Canadian Economic Statistics" 2021 updated for 2021.

period 1990-2021 are close to zero. For the period 1981-2021 the AM estimate of the market risk premium is only 0.22% while the OLS and GM estimates are both negative. We then need to go back to the 1950's before the market risk premium gets much above 4.0%. Of importance is that even going back 30 years we only get a market risk premium of just over 2.0% and that is about the time of current financial professionals.

In Schedule 2 is the AM risk premium for various holding periods. If we look at the last row, we have the AM risk premium for various start dates finishing in 2021, this is essentially a subset of the data graphed in Schedule 1 and illustrates the experience of market professionals starting at different dates. For example, for the most recent 20-year period the earned market risk premium was 3.38%, as we go back successively by adding an extra ten years of data each time the earned risk premium decreases to 2.45% for someone starting in 1992, and then to 0.40% for someone starting in 1982, which would be someone in their mid-60's. If we go back to 1942, we get the highest market risk premium of 5.39% for a professional who would now be over 100 years old. Otherwise, the data is simply statistics and not lived experience.

The usefulness of the different holding periods in Schedule 2 is simply to note the variability in the AM estimate of the experienced market risk premium that comes from using sub-sets of the data. A "high" estimate can, for example, be estimated by looking at the last ten years whereas a "low" estimate would be from starting in the early 1980's. In both cases, the choice is the result of a long cycle in Canadian interest rates rather than any changes in equity market performance.

We can illustrate this problem simply by graphing the behaviour of interest rates, which is the graph in in Schedule 3. Note for example, that there was very little interest rate variability in the 1930's. This was because "modern" monetary policy did not exist in North America until the Federal Reserve's "Accord" with the US Treasury in 1951. Subsequently, interest rates started to increase with inflation; thereby causing losses to anyone holding long-term bonds. This is because as interest rates go up bond prices and the return from holding bonds goes down. This process ended in the period 1981-1989, after which it has gone into reverse until we reach the current period of exceptionally low interest rates when the yield on the over 10-year maturity long Canada bond ended 2021 at just 1.75% (Cansim series V122487), which was a negative rate given the year over year inflation rate.

Changes in the Market Risk Premium

The fact that estimates of the market risk premium change over time indicates that some adjustments are in order. In my judgment the riskiness of the equity market is relatively stable. In fact, going back as far as 1871, there is substantial evidence that the average real return on US equities has been quite stable[3] However; there is ***no*** support for the assumption that either bond market risk or average bond market returns have been constant. As Schedule 3 shows, from 1924-1956, there was very little movement in nominal interest rates. As a result, the standard deviation of annual bond market returns was only 5.18%. In contrast, from 1957-2021, monetary policy became progressively more important and interest rates more volatile. As a result, the standard deviation of the returns from holding the long Canada bond increased to 9.83%, that is, bond market risk almost doubled. In contrast, equity market risk, as measured by annual volatility declined from 21.57% to 16.20%.

This changing bond market risk is illustrated in Schedule 4, which graphs the equity market risk divided by the bond market risk. The risk is estimated as the standard deviation or volatility of returns over the prior ten-year period, so the series starts with the first observation for the period 1924-1933. We can clearly see the dramatic decrease in equity relative to bond market risk starting in the 1950s as changing monetary policy made bonds riskier. During this period equities dropped from being six times riskier than long-term Canada bonds to their low point in the early 2000's of very similar risk. Since then, the traditionally higher equity market risk asserted itself again until the period after the 2008/9 financial crisis. For the last ten years equity market risk (volatility) has only been about 50% greater than bond market risk.

However, what is crucial for the investor is whether this risk is diversifiable, that is, what happens when you hold bonds along with equities in a diversified portfolio. Schedule 5 has the Canadian bond market "beta" showing that it was very large during the period from the mid-1980s until the early 2000's when governments had severe financial problems and flooded the market with government debt. This caused both the bond and equity markets to react to a common risk factor: market interest rates. Adding long Canada bonds to an equity portfolio

[3] See Laurence Booth, "Estimating the Equity Risk Premium and Equity Costs: New Ways of Looking at Old Data", *Journal of Applied Corporate Finance*, Spring 1999.

during the 1990's did not reduce risk to the extent that it did in either earlier or later periods.[4]

Clearly for the market risk premium to be constant it must be the case that the relative risk between equities and bonds is constant or at least similar. In Schedule 6 are the results of a regression analysis of the real Canada bond yield against various independent variables. The real Canada bond yield is defined as the nominal yield minus the average CPI rate of inflation, calculated as the average of the current, past, and forward year rates of inflation.[5] The regression model explains a large amount of the variation in real Canada yields, and six variables are highly significant.

The two main "independent" variables capture bond market uncertainty (risk) and the endemic problem of financing government expenditures (deficits). Risk is the standard deviation of the return on the long Canada bond over the preceding ten years. In earlier periods prior to active monetary policy, interest rates barely moved and the returns on long Canada bonds were stable. As a result, the risk of investing in bonds was very low and as Schedule 4 showed equity market risk was at times up to 6 times that of the bond market. The coefficient on the risk variable indicates that for every 1% increase in bond market volatility, real Canada yields increased by about 0.24%. That is, the approximate 5% increase in the standard deviation of bond market returns before and after 1956 was associated with over a 1% increase in real Canada yields between these two periods. In other words, active monetary policy by changing interest rates has increased bond market risk.

The deficit variable is the total amount of government "lending" (from all levels of government) as a percentage of the gross domestic product. Statistics Canada reports this as lending but usually it is negative, that is, deficits and government borrowing. The coefficient in the model indicates that for every 1% increase in government borrowing, real Canada yields increased by about 26 basis points. That is, increased government borrowing by competing for funds with other borrowers drives up real interest rates. For 1992, the deficit was 9.10% of GDP, which was

[4] During this period, the Government of Canada long-term bond had as much market risk as low risk Canadian utilities. At that time some utilities were allowed a lower return on equity than the prevailing long term Canada bond yield.

[5] Before 1991 there was no real return bond.

a peacetime record high until the Covid 19 pandemic struck. At the peak of the government's financing problems in 1992 a 9.1% deficit was adding well over 2.0% to the real Canada yield relative to what would have happened with a balanced budget. These two effects can explain the huge increase in real interest rates in the early 1990s. In 1994, for example, when real yields were about 7.42%, the deficit added about 1.75% and the bond market uncertainty about another 2.6% or in total close to 4.5% to the real yield. Conversely in 2008 prior to the financial crisis the government deficit had grown to a surplus of 0.25% while bond market risk had declined to 6.25%. So as a result, the real yield dropped to just 2.42%.

The four “dummy” or indicator variables represent unique periods of intervention in the financial markets. An indicator variable simply inserts a “1” for the years when this special phenomenon was in effect. Dum1 is for the years from 1940-1951, which were the "war" years, when interest rates were effectively controlled to finance both the second world war expenses and the post war recovery. For example, in 1944 the government ran a deficit of over 20% of GDP, which normally would have caused a huge increase in interest rates except for government controls and the promotion of bond purchases. The coefficient indicates that real Canada yields were reduced by over 5.0% below where they would otherwise have been. Similarly, Dum2 is for the years 1972-1980, which were the oil crisis years, when huge amounts of "petrodollars" were recycled from the suddenly, oil rich, OPEC countries back to western capital markets and oil importing countries. The sign on Dum2 indicates that, but for this petrodollar recycling real long Canada bond yields would have been about 3.6% higher.[6]

Dum3 is for the recent period of unconventional monetary policy and central bank bond-buying since 2010, where countries like the U.S engaged in massive bond buying programs to stimulate investment and lower mortgage rates. During this period unconventional monetary policy effectively lowered the real yield by about 2.7% below where it would have been without the extreme measures taken in the US, UK, Europe, and Japan. Finally, 2020 and 2021 are special unto themselves since with a budget deficit of over 10% of GDP in 2020, the Bank of Canada started financing the government deficit by buying 40% of the Treasury bill auction and $5

[6] These years can be viewed as a tax on oil importing countries and the inflation that resulted as the “working out” of who pays the tax.

billion of Government of Canada bonds at auction. In this way the Bank of Canada joined similar programs elsewhere around the world with massive central bank government bond buying programs. These programs have clearly been effective as the coefficient indicates that real yields in Canada were 6.65% below where they would otherwise have been or an additional 4% below the already depressed real yields. The result has been record-low real yields last seen during the petrodollar recycling crisis and the war years.

Of importance is that these indicator variables are included due to known periods of intervention that have prevented the "normal" application of financial principles in the bond market. Essentially, real yields have not been determined by private sector participants trading off risk versus return, instead they have been determined by government agents for political, rather than underlying economic reasons.

In Schedule 7 is a graph of the unexplained "error" from two models. The first is the error from the real yield model that excludes the financial crisis and Covid 19 indicator variables ("without") and the second includes both of them ("with"). What is clear is that there is a very large model over-prediction (negative error) in the period after the financial crisis. In contrast, once Dum 3 and Dum 4 are added this error largely disappears. In other words, the real yields for the last two years have in the main not been determined by private sector participants.

In Schedule 8 is a graph of the real yield produced directly from the real return bond. Unfortunately, this data is not available for earlier periods since these bonds did not exist. However, we can see the huge decline in the real yield as governments have regained control over their budgets, uncertainty in the bond market has declined and monetary policy has been loose. For the period 1991-2000 the real yield was 4.0-4.5%, whereas in the after math of the financial crisis it has averaged less than 2.0% before collapsing to negative levels during 2020.

US Estimates

The prior discussion indicates that much of the dispute over the market risk premium is related to the behaviour of the bond and not the equity market. However, the Canadian data is one time series of equity and bond market returns and may reflect circumstances unique to Canada. Checking on US data allows an assessment as to whether these estimates are reasonable.

Schedule 9 provides US estimates of the market risk premium along with the comparable Canadian estimates for the period 1926-2021.

Regardless of whether we estimate the AM, GM or OLS average, the historic record is that the US estimate of the market risk premium is higher than in Canada. Given the higher "quality" of the US data as well as the volatility of the estimates, many put greater faith in the US estimates. This is also frequently justified by the doubt expressed at the "higher risk"[7] Canadian market having a lower market risk premium, as well as the increasing integration between the two capital markets, which "presumably" moves Canada closer to the US experience.

However, the difference between the US and Canadian AM market risk premium estimates since 1926 of 1.56% (6.36%-4.80%) is split between a difference in the average equity return of 1.25% and a difference in the average government bond return of 0.31%, that is approximately a 4:1 equity-bond market split. In explaining this, note that:

- The difference between the equity market returns can partly be explained by the historic efforts of Canadian governments to segment the Canadian equity market from that in the US[8], by the historically slightly lower risk of the Canadian market and the "survivor bias" of the success of the US economy which means their equity returns are probably greater than expected.
- The difference in the bond market returns reflects the pivotal role of the US government bond market in the world capital market as the US $ became the world's reserve currency after the Second World War.

However, these historic factors while they may explain the historic differences may not be as relevant for the future. Canada, for example, is in a relatively favourable position as an "AAA" rated borrower that until recently had solved most of its structural deficit problems. Favourable government finances have resulted in low inflation and interest rates, and the removal of the foreign property restriction on tax preferred investments. We can see this in the graph of long-term interest rates in Canada and the US in Schedule 10. In the mid 1990s the nominal yield on

[7] Note, however, that the standard deviation or variability of the S&P500 equity returns was 19.63% or 1.41% higher than that for the Canadian market. Over the whole period, US equities were marginally ***more*** risky than Canadian equities with most of this coming from the pre-war period.

[8] The dividend tax credit only applies to dividends from Canadian corporations; foreign withholding taxes apply to foreign source income, while portfolio restrictions have existed in tax-preferred plans.

long Canada bonds was routinely higher than that on equivalent US treasury bonds. However, this started to change as the Government of Canada moved into a surplus position and since the mid 2000's long Canada bonds have usually had lower yields than US Treasuries. This is shown more clearly in Schedule 11 which graphs the yield spread that is, the difference between long term Canadian government bond yields minus those in the US. Typically, long Canada bonds have recently had yields a bit less than 0.50% less than equivalent US Treasuries.9

All else constant, this swing of over 1.0% in the Canadian bond yield versus that in the US would raise the estimate of the Canadian equity market risk premium simply because it is now over a lower Canadian bond yield. *As a result, although my direct estimate of the Canadian market risk premium is 4.80% from 1926, I judge it reasonable to adjust this upwards for the changes in the long Canada bond yield relative to that in the US and these other changes. I therefore judge a reasonable range for the historic market risk premium to be 5.5-6.0%.*

Reasonableness of the Estimates

In assessing the reasonableness of the prior statistical work, we can look at what professionals' use. On July 17, 2019, BVWire[10] reported the results of a small survey which indicated the following data sources were relied on by professionals:

- 69% said they use Duff and Phelps
- 45% Professor Aswath Damadoran
- 13% Professor Pablo Fernandes

Duff and Phelps purchased the original data from Ibbotson and Sinquefield which has a long history of being used in regulatory hearings and was originally developed at the University of Chicago.[11] Duff and Phelps base their market risk premium and cost of capital report on this data and market their "Cost of Capital Navigator" product.[12] This is a subscription-based product that provides cost of capital estimates for US and international companies. While this is a

9 Since 2010 the difference has averaged 0.42%.

[10] Business Valuation Resources, BVWire 202-2, July 17, 2019.

[11] R. G. Ibbotson and R. Singuefield, Stocks, bonds, bills, and inflation: year by year historical returns (1926-1974), *Journal of Business* 49-1, pp 11-47.

[12] See Cost of Capital Navigator | Duff & Phelps (dpcostofcapital.com)

subscription-based product they provide their overall market risk premium estimates on their web page, which I reproduce as Schedule 12.

In 2021 Duff and Phelps became a Kroll business and in September 2021 their estimate of the equity market risk premium was 5.50% over a 2.50% "normalised" 20 year US Treasury yield for an equity market return of 8.00%. As they explain in the footnote, normalised is a proxy for a longer term risk-free rate when the currrent rate is abnormally low due to central bank intervention, as it is now. Since the inception of the Duff and Phelps service in 2008 their recommended market risk premium estimate has ranged between 5.0% and 6.0%, the most important change has been not in the market risk premium but the risk-free rate over which it is measured. Duff and Phelps has variously used the spot or actual risk-free rate or a normalised rate ranging from 2.5% to 4.5%. However, the important point is that Duff and Phelps (Kroll) current market risk poremium is at the bottom of my own 5.5-6.0% range.

Aswath Damodaran is a Professor of Finance at New York University's Stern School of Business. Damodaran teaches corporate finance and valuation and has a keen interest in equity risk premiums. At Schedule 13 is his graph of the "implied" equity risk premium from 1960 to 2019.[13] This estimate is based on "potential" dividends as a proxy for cash flow and a two stage discounted cash flow model. What is striking is that only rarely does his implied equity or market risk premium exceed 6.0% and for the last ten plus years it has also been in the 5.0-6.0% range that I have used. Moreover I would regard his estimates as high for three reasonss: 1) his cash yield includes the impact of share buybacks, but not new share issues so includes one but not the other and is high; 2) he uses analyst growth estiates which even for the overall market may be high, which is why he tapers them with the long run growth rate using the two stage DCF model; and 3) his risk premium is over the ten year US government yield instead of the long term yield as is the practise in regulatory hearings in Canada. His estimates for the market risk premium in 2020 and 2021 are for 4.71% and 4.24% respectively.

[13] Taken from page 99 of Equity risk premiums (ERP): Determinants, estimation, and implications- the 2020 Edition.

The final source is the annual survey work of Professor Pablo Fernandes[14] and his co-authors.[15] They survey professionals around the world to find out what they use for the market risk premium. The professionals include analysts in companies, investment banks and professors. A key result from his survey and his table 2 is reproduced below. The table indicates that with 1,756 responses the average US market risk premium was estimated to be 5.5% with the typical (median) value the same. The average market risk premium from the 38 responses in Canada was 5.6% with a median value of 5.5%. Noticeably, the highest value reported by any finance professional in Canada was 9.2 and the U.S. 8.0%. With a vastly larger number of people responding in the US the range between the minimum and maximum values is from 3.1% to 8.0%. I suspect that the range is largely due to the difference between thinking of the market risk premium based on AM or GM returns.

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Market Risk Premium and Risk-Free Rate used for
88 countries in 2021

Table 2. Market Risk Premium (MRP) used for 88 countries in 2021

MRP	Number of Answers	Average	Median	MAX	min
USA	1756	5,5%	5,5%	8,0%	3,1%
Spain 2021	539	6,4%	6,4%	11,4%	4,0%
Angola	11	11,5%	11,7%	15,0%	6,0%
Argentina	16	17,4%	16,5%	60,0%	4,0%
Australia	31	6,4%	6,3%	10,0%	2,0%
Austria	96	5,9%	6,0%	8,0%	4,0%
Bangladesh	13	7,0%	7,1%	15,0%	1,1%
Barbados	10	11,1%	11,3%	12,4%	8,0%
Belgium	98	5,9%	6,0%	8,0%	4,0%
Bolivia	11	9,1%	9,4%	10,5%	6,6%
Bosnia	9	10,1%	10,3%	11,4%	6,8%
Brazil	42	7,7%	7,8%	12,0%	2,0%
Bulgaria	15	6,8%	6,7%	8,1%	6,3%
Canada	38	5,6%	5,5%	9,2%	3,5%
Chile	21	6,3%	6,3%	9,0%	2,8%
China	30	6,2%	6,0%	17,0%	3,0%
Colombia	13	6,9%	6,8%	8,7%	6,0%
Costa Rica	9	9,4%	9,5%	10,5%	6,8%

[14] Survey: Market risk Premium and Risk-Free Rate Used for 88 countries in 2021," IESE Business School, June 21, 2021. Previous survey results were reported in "Market risk premium used in 71 countries in 2016: a survey with 6,932 answers, *Journal of International Business Research and Marketing,* 2(6), pp 23-31.

[15] These include financial analysts, corporate analysts, and finance faculty.

A feature of Fernandez's recent surveys is that they also surveyed the use of the risk-free rate in estimating the required rate of return to obtain the overall equity cost for the market. which is below.

Table 4. Km [Required return to equity (market): RF + MRP)] used for 88 countries in 2021

Km	Number of Answers	Average	Median	MAX	min
USA	1756	7,3%	7,3%	13,0%	4,0%
Spain 2021	539	7,4%	7,4%	12,4%	4,8%
Angola	11	20,5%	20,9%	23,0%	15,4%
Argentina	16	41,6%	43,8%	100,0%	9,5%
Australia	31	9,0%	8,8%	15,0%	2,5%
Austria	96	6,6%	6,5%	8,7%	4,8%
Bangladesh	13	11,4%	11,8%	23,0%	2,7%
Barbados	10	15,4%	15,7%	16,8%	12,5%
Belgium	98	6,5%	6,5%	8,7%	4,8%
Bolivia	11	13,9%	14,8%	15,9%	9,6%
Bosnia	9	13,8%	14,2%	15,3%	13,2%
Brazil	42	14,2%	14,0%	18,0%	7,5%
Bulgaria	15	8,8%	8,8%	12,8%	6,5%
Canada	38	7,6%	7,3%	13,6%	4,8%
Chile	21	10,2%	10,2%	12,7%	3,0%
China	30	9,0%	9,0%	11,5%	5,0%
Colombia	13	13,8%	13,9%	15,4%	11,0%
Costa Rica	9	11,6%	12,0%	12,9%	11,0%

The overall average and median equity market return are 7.3% in the US and 7.6% and 7.3% in Canada. I would judge they are both typically (median) estimating an overall equity market cost of 7.3%.

Similar to Duff and Phelps, Credit Suisse now produces an annual "Global Investment Returns Yearbook." The critical equity risk premium data is summarized in their Figure 11 reproduced in my Schedule 13. Between 1900 and 2020, the equity risk premium over Treasury Bills was highest at just over 6.0% in Japan, but in no country was the equity risk premium over long term bonds materially above 5.0%.

Overall, I would summarise my market risk premium estimate relative to these other commonly used services as:

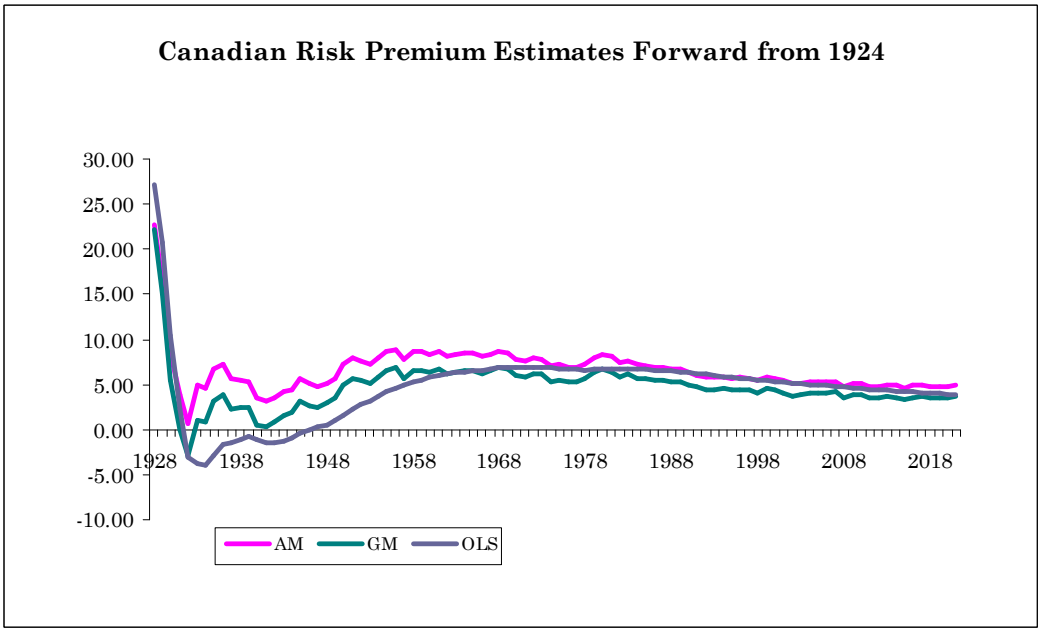
Booth historic range: 5.5%-6.0% mid point: 5.75%

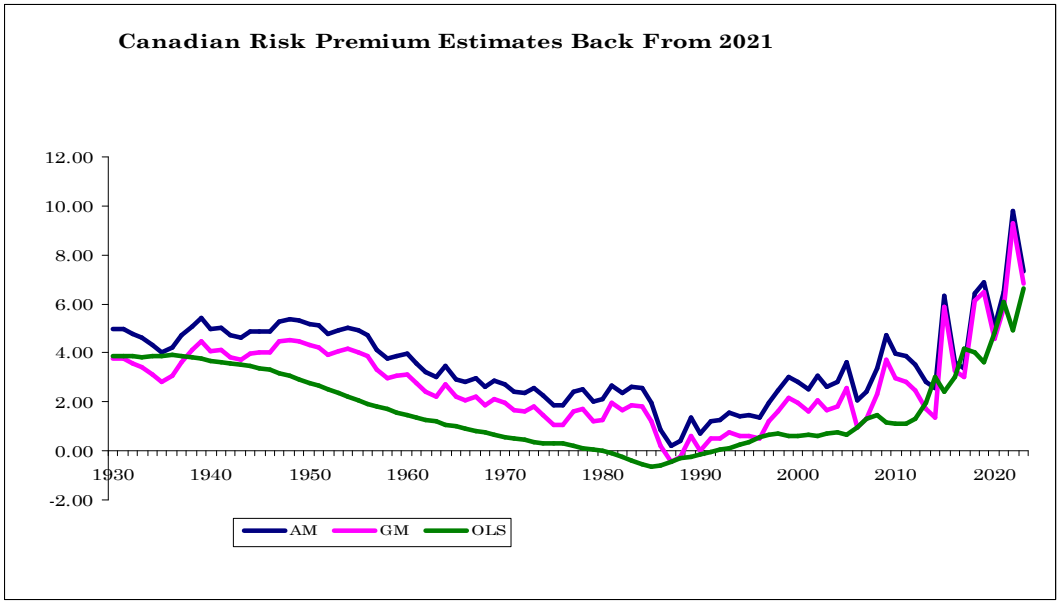
Duff and Phelps (US):	5.5%
Damodaran (US):	4.24%
Fernandes survey:	5.5%
Credit Suisse (about):	4.2%

Conclusions

Professor Fernandez's survey work, the academic work of Aswath Damodaran and the professional work by Duff and Phelps and Credit Suisse all support my own empirical work but would place my Canadian market risk premium range of 5.5-6.0% as marginally high. I would judge the 6.2% US estimate as reflecting some survivor bias as the best performing economy over this period. Overall, I judge a reasonable range for the market risk premium as being 5.5-6.0%. The survey estimates of Fernandes and the estimates of Duff and Phelps (Kroll) also support an overall equity market return of 7.3-8.0%, which imply an upper bound for the equity cost for lower risk regulated utilities.

SCHEDULE 1


Canadian Risk Premium Estimates Forward from 1924
30.00
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
1928
1938
1948
1958
1968
1978
1988
1998
2008
2018
AM
GM
OLS


Canadian Risk Premium Estimates Back From 2021
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
AM
GM
OLS

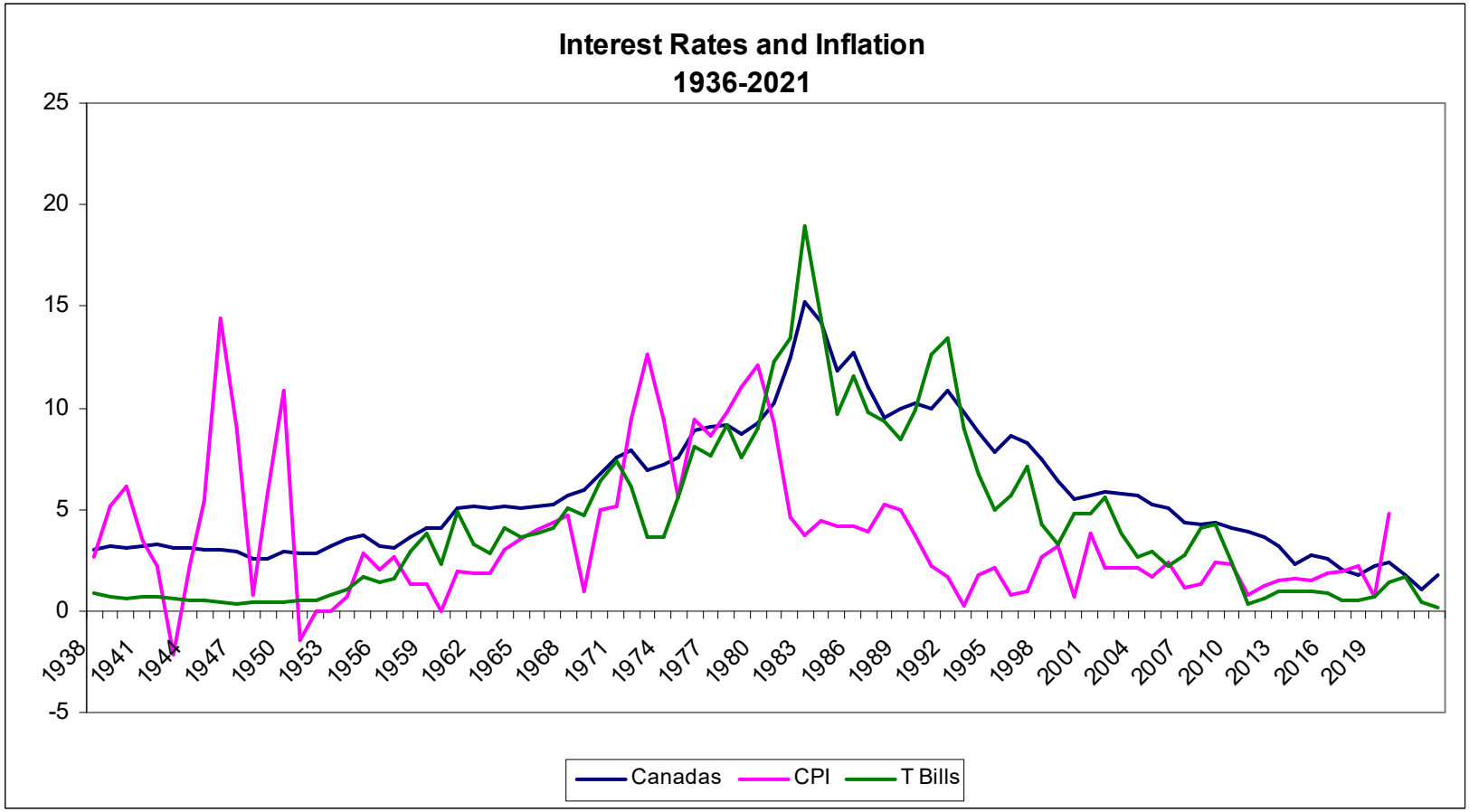
SCHEDULE 2

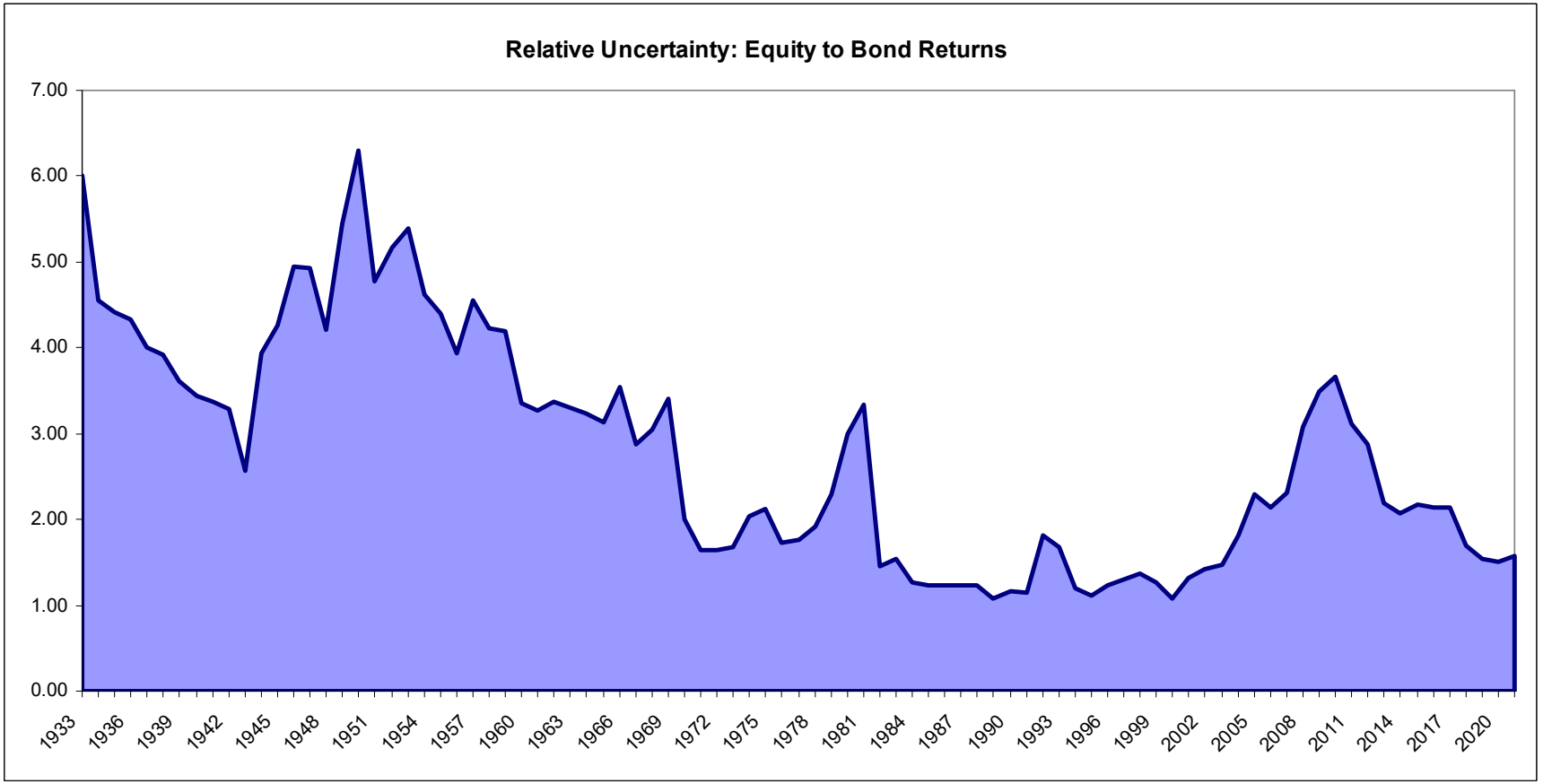
Arithmetic Earned Risk Premiums for Different Holding Periods

Start dates on the horizontal and ending dates on the vertical. For example, an investor would have earned a 0.94% arithmetic risk premium investing from 1962-2011.

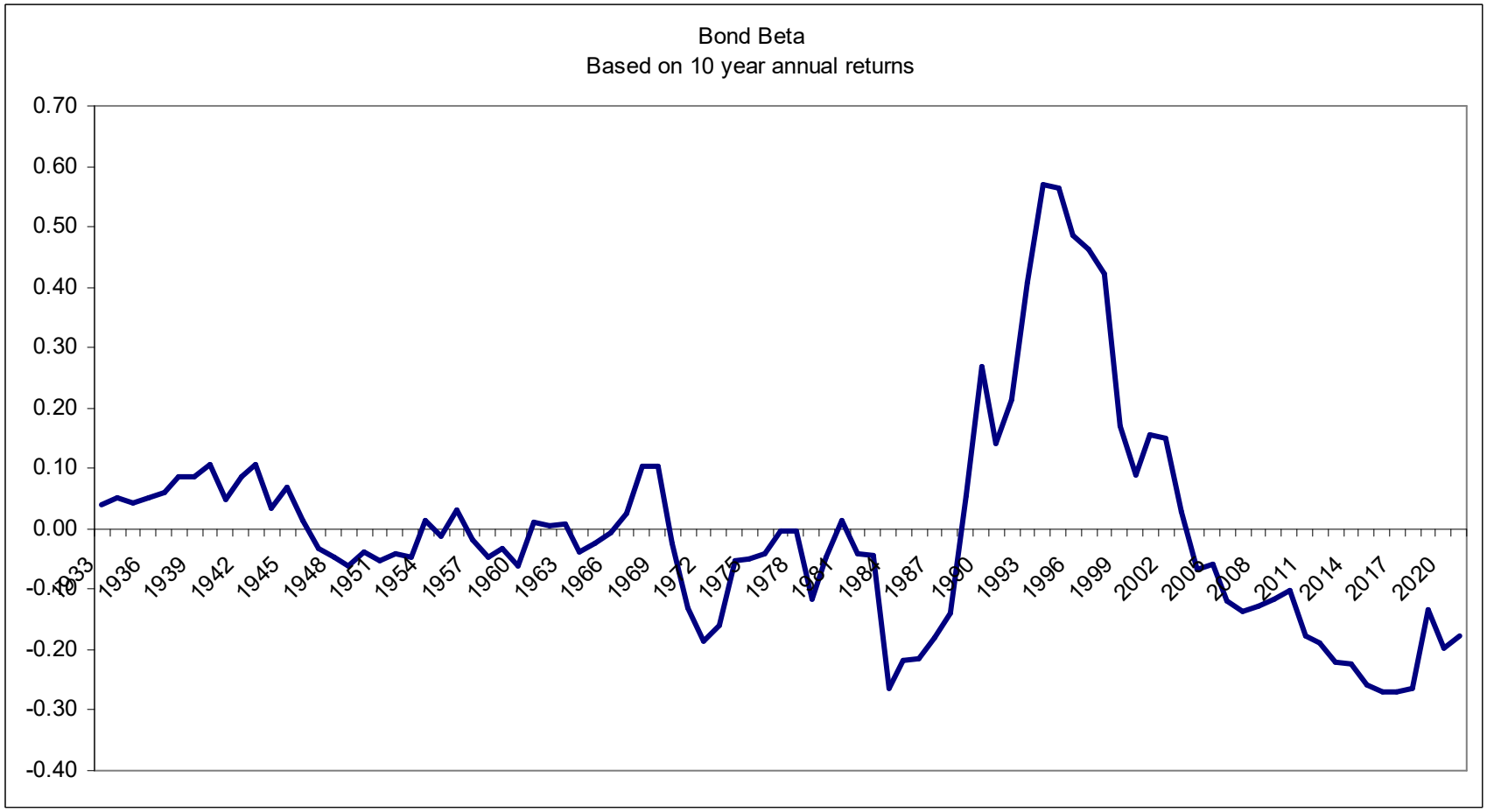
	1924	1942	1952	1962	1972	1982	1992	2002
1941	3.13							
1951	7.92	16.55						
1961	8.66	13.64	10.73					
1971	7.53	10.17	6.98	1.62				
1981	8.12	10.37	8.31	3.55	5.48			
1991	6.09	7.15	4.80	1.41	1.31	-5.72		
2001	5.38	6.06	3.96	1.13	0.97	-2.58	0.57	
2011	4.80	5.24	3.35	0.94	0.77	-1.61	0.44	0.31
2021	4.97	5.39	3.79	1.32	1.26	0.40	2.45	3.38

SCHEDULE 3


Interest Rates and Inflation
1936-2021
25
20
15
10
5
0
-5
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
2013
2016
2019
Canadas
CPI
T Bills


Relative Uncertainty: Equity to Bond Returns
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1933
1936
1939
1942
1945
1948
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
2011
2014
2017
2020

SCHEDULE 5


Bond Beta
Based on 10 year annual returns
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
1933
1936
1939
1942
1945
1948
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
2011
2014
2017
2020

SCHEDULE 6

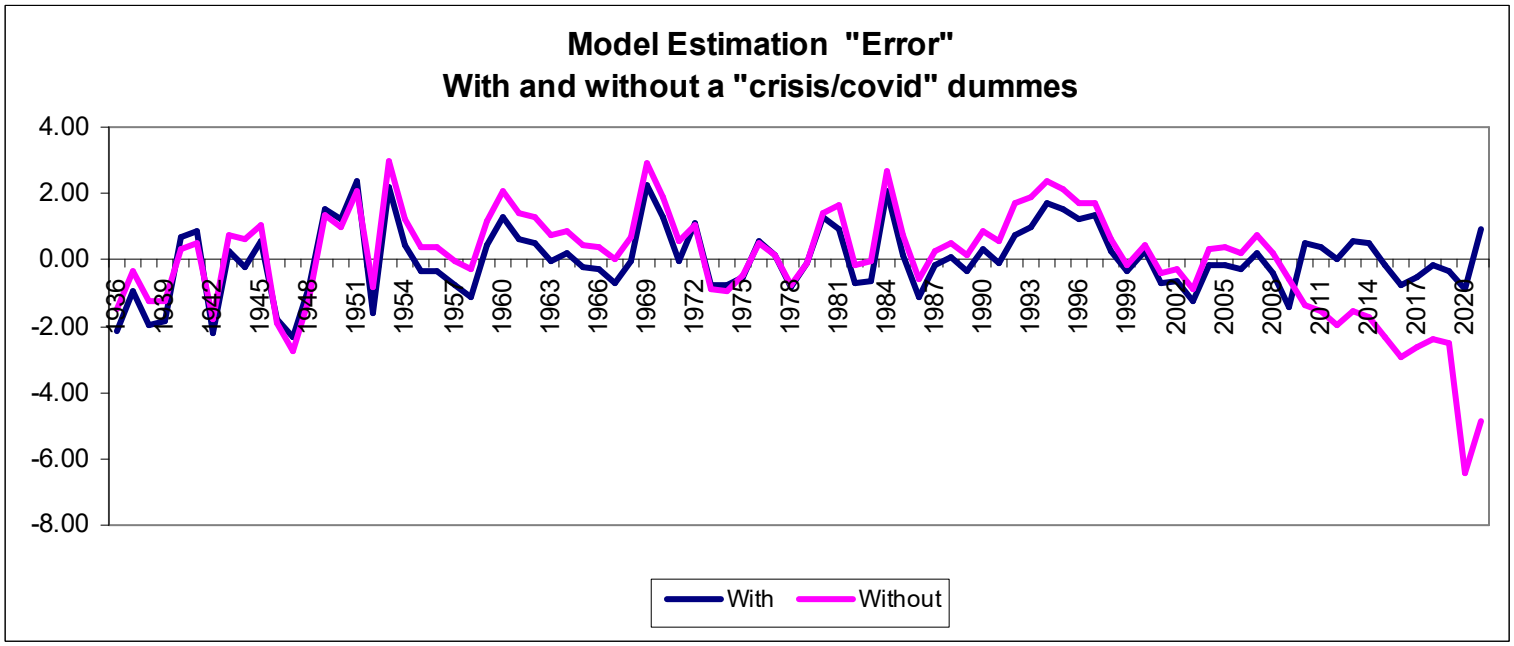
FACTORS INFLUENCING THE REAL CANADA YIELD

Dependent variable: Long Canada (over 10) yield minus the average CPI inflation rate for the past, current, and forward year.

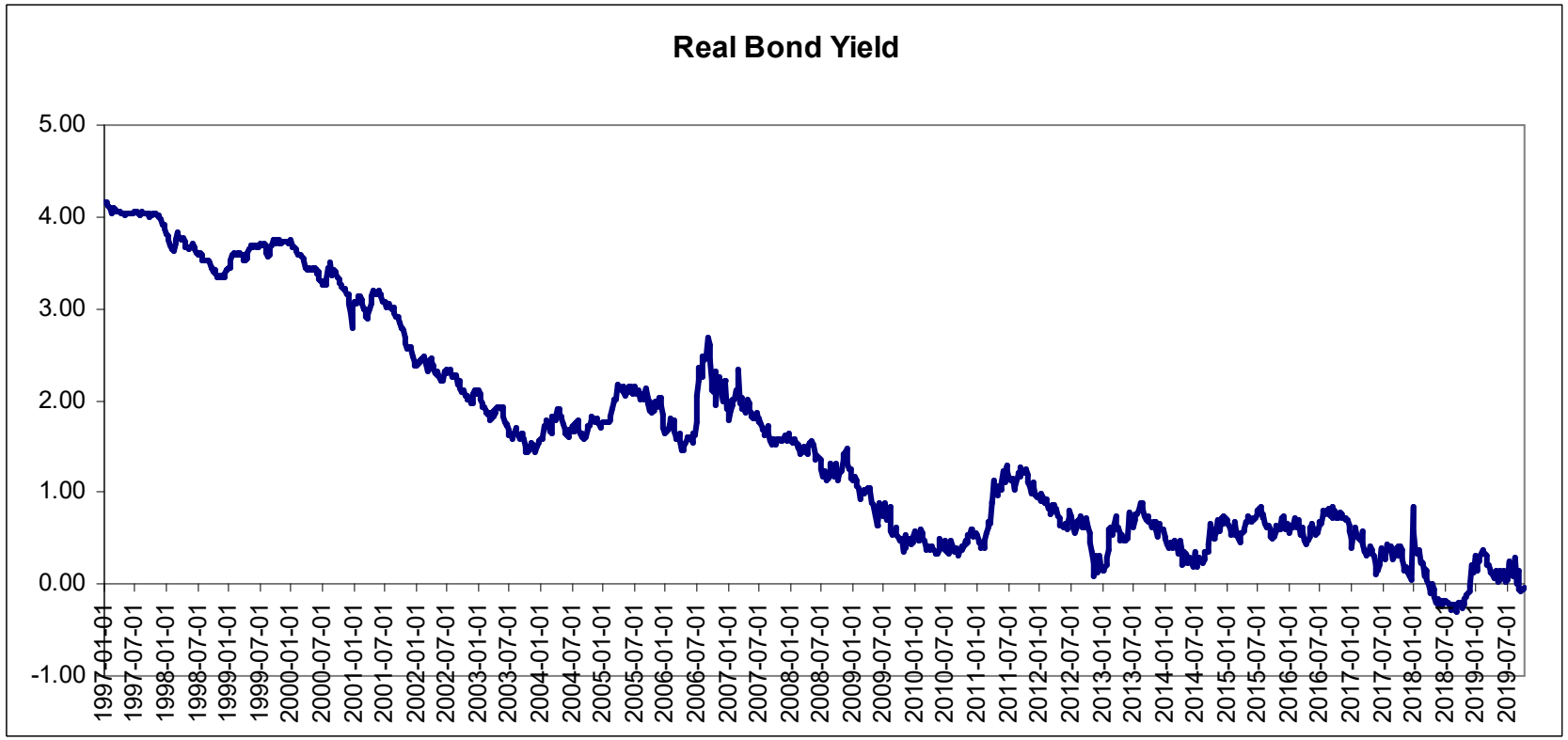
Independent variables:

	Coefficient	T-Statistic
Constant:	1.374	3.76
Risk: standard deviation of return on the Long bond index for the prior ten years.	0.235	5.40
Deficit: aggregate government lending (% of GDP).	-0.259	-9.20
Dum1: dummy variable for years 1940-51	-5.340	-13.72
Dum2: dummy variable for years 1972-80	-3.631	- 9.47
Dum3: dummy variable for years 2010-2020	-2.689	- 7.33
Dum 4 dummy for 2020 and 2021	-6.656	-8.41

Adjusted R^2 of the regression 86.41%
Data 1936-2021



"Without" indicates without a crisis and Covid 19 indicator variable "with" includes them. Both are estimated by standard ordinary least squares.


Real Bond Yield
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
1997-01-01
1997-07-01
1998-01-01
1998-07-01
1999-01-01
1999-07-01
2000-01-01
2000-07-01
2001-01-01
2001-07-01
2002-01-01
2002-07-01
2003-01-01
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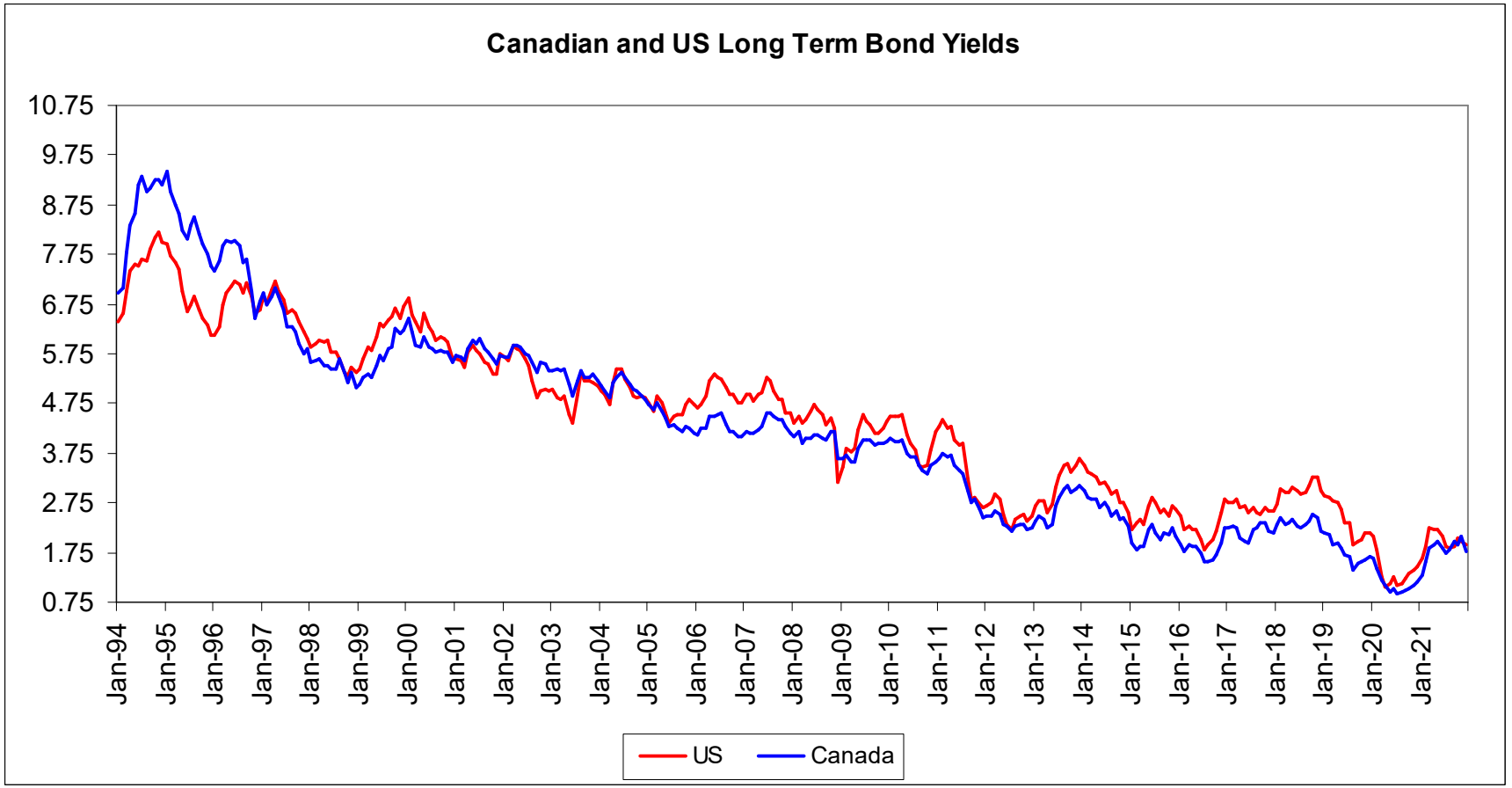
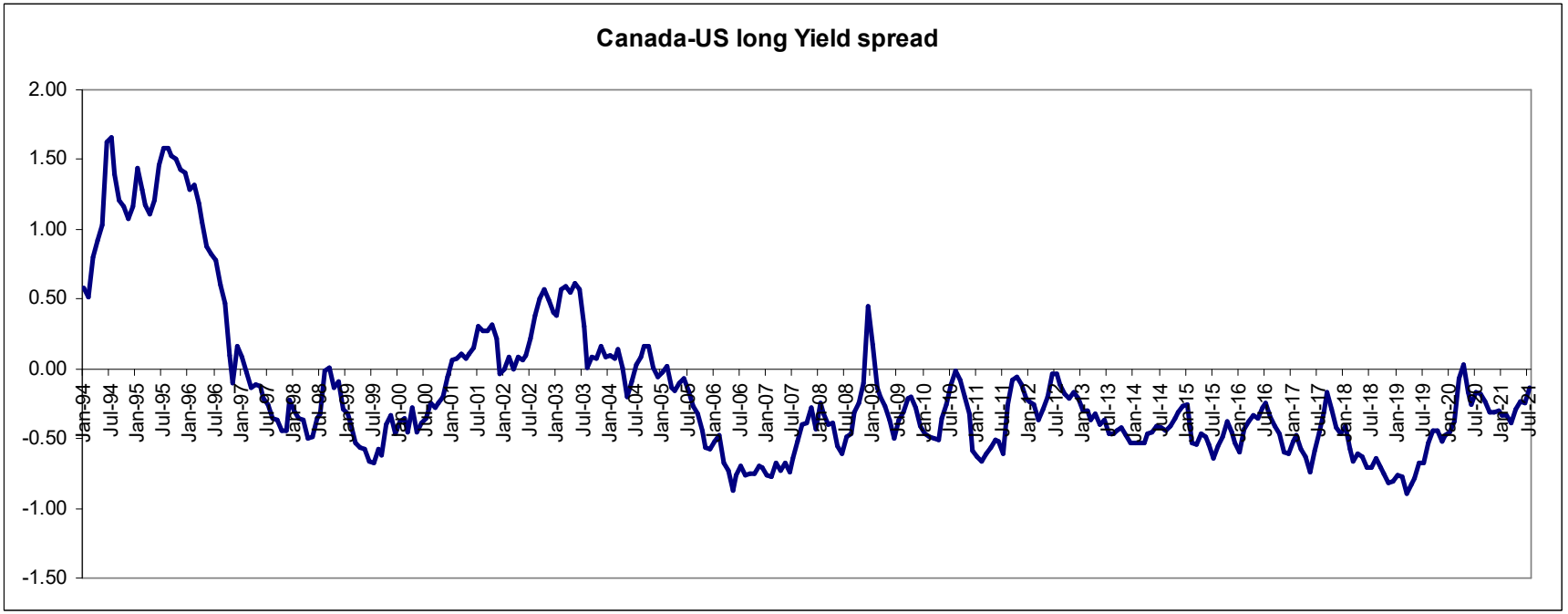
2015-01-01
2015-07-01
2016-01-01
2016-07-01
2017-01-01
2017-07-01
2018-01-01
2018-07-01
2019-01-01
2019-07-01

Annual Rate of Return Estimates 1926-2021						
	U.S.			**CANADA**		
	S&P Equities	Long US Treasury	Excess Return	TSE Equities	Long Canadas	Excess Return
AM	12.33	5.96	6.24	11.07	6.27	4.80
GM	10.46	5.53	4.93	9.50	5.93	3.57
OLS	10.90	5.65	5.25	10.10	6.25	3.85
Volatility[1]	19.63	9.83		18.22	8.77	

SCHEDULE 10


Canadian and US Long Term Bond Yields
10.75
9.75
8.75
7.75
6.75
5.75
4.75
3.75
2.75
1.75
0.75
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
US
Canada

SCHEDULE 11


Canada-US long Yield spread
2.00
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
Jan-94
Jul-94
Jan-95
Jul-95
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Jan-05
Jul-05
Jan-06
Jul-06
Jan-07
Jul-07
Jan-08
Jul-08
Jan-09
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Jan-10
Jul-10
Jan-11
Jul-11
Jan-12
Jul-12
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Jul-18
Jan-19
Jul-19
Jan-20
Jul-20
Jan-21
Jul-21

DUFF&PHELPS
A KROLL BUSINESS

Cost of Capital in the Current Environment

COVID-19 Update – September 2021

U.S. Cost of Capital Inputs

Data as of September 20, 2021

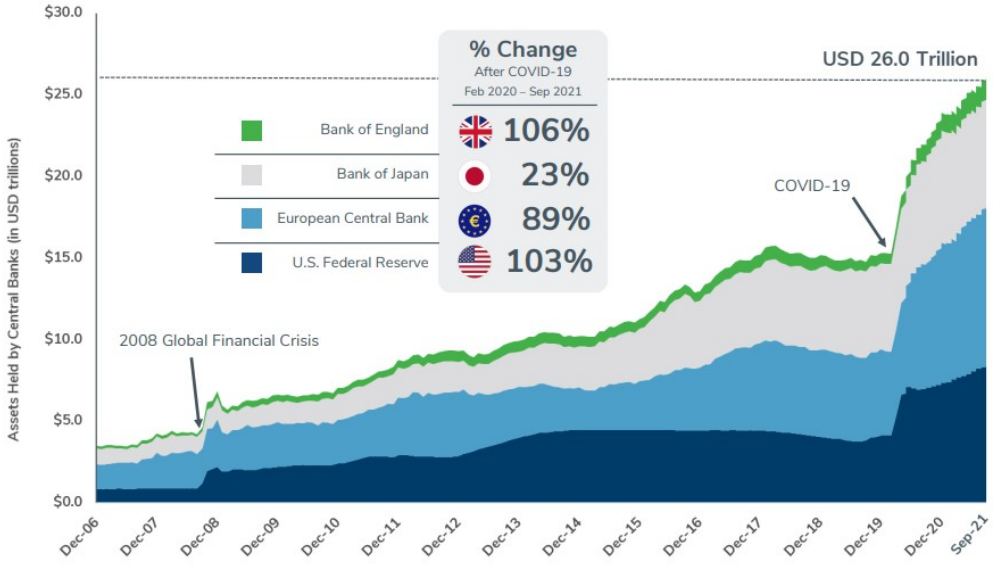
5.5% Duff & Phelps-Recommended Equity Risk Premium

2.5% Normalized Risk-Free Rate

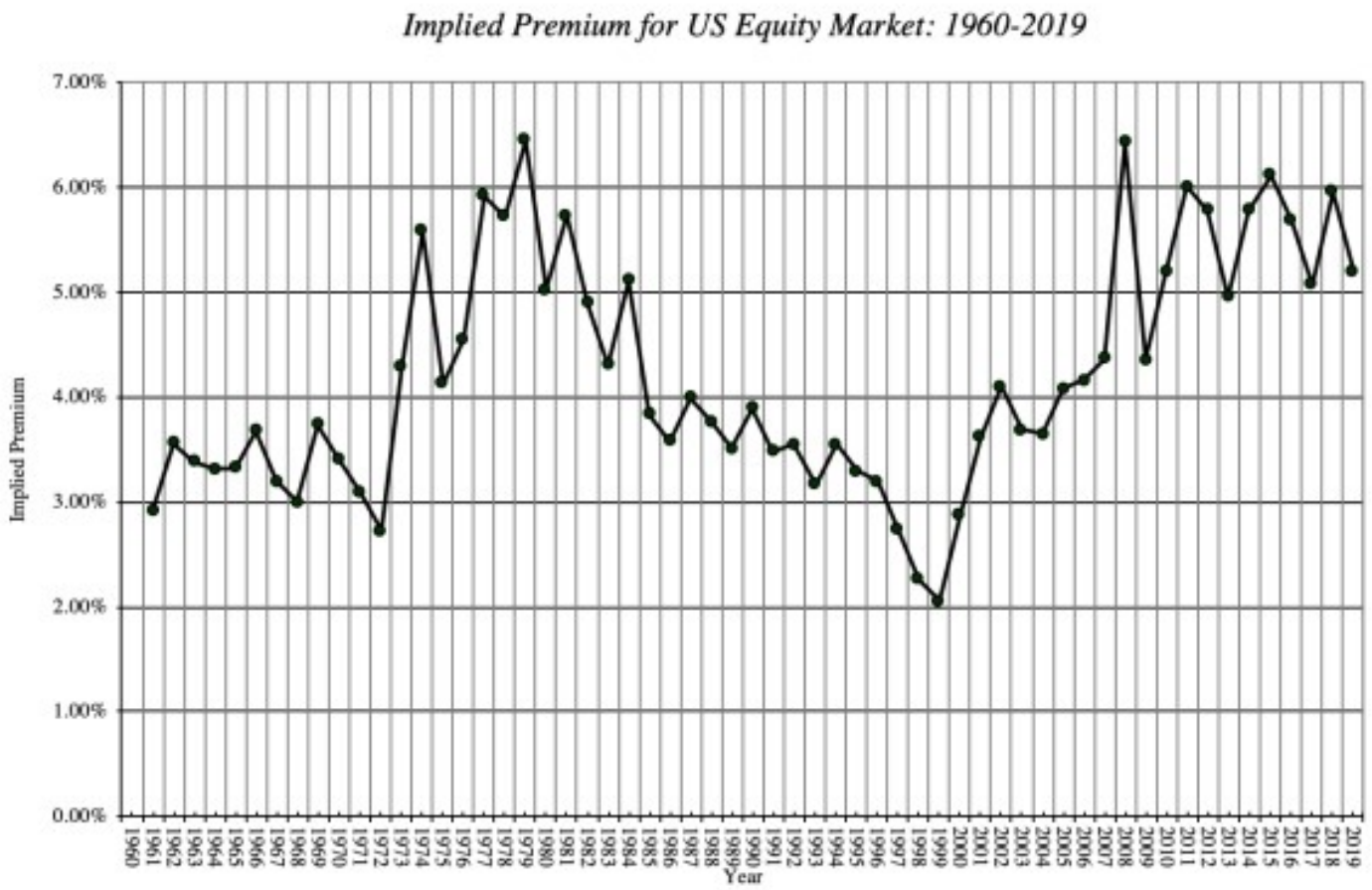
Duff & Phelps, A Kroll Business continues to monitor risk-free rates and other cost of capital inputs closely. If and when (i) long-term spot yields increase to a level that approaches the Duff & Phelps-recommended U.S. normalized risk-free rate (e.g., differences are lower than 50 b.p.), and (ii) there is evidence that this increase in spot yields is not transitory, we will then consider recommending a return to using spot 20-year U.S. Treasury Yields as the basis for the risk-free rate to be used in conjunction with our recommended U.S. Equity Risk Premium.

Total Assets Held by Major Central Banks Over Time

Data as of September 20, 2021

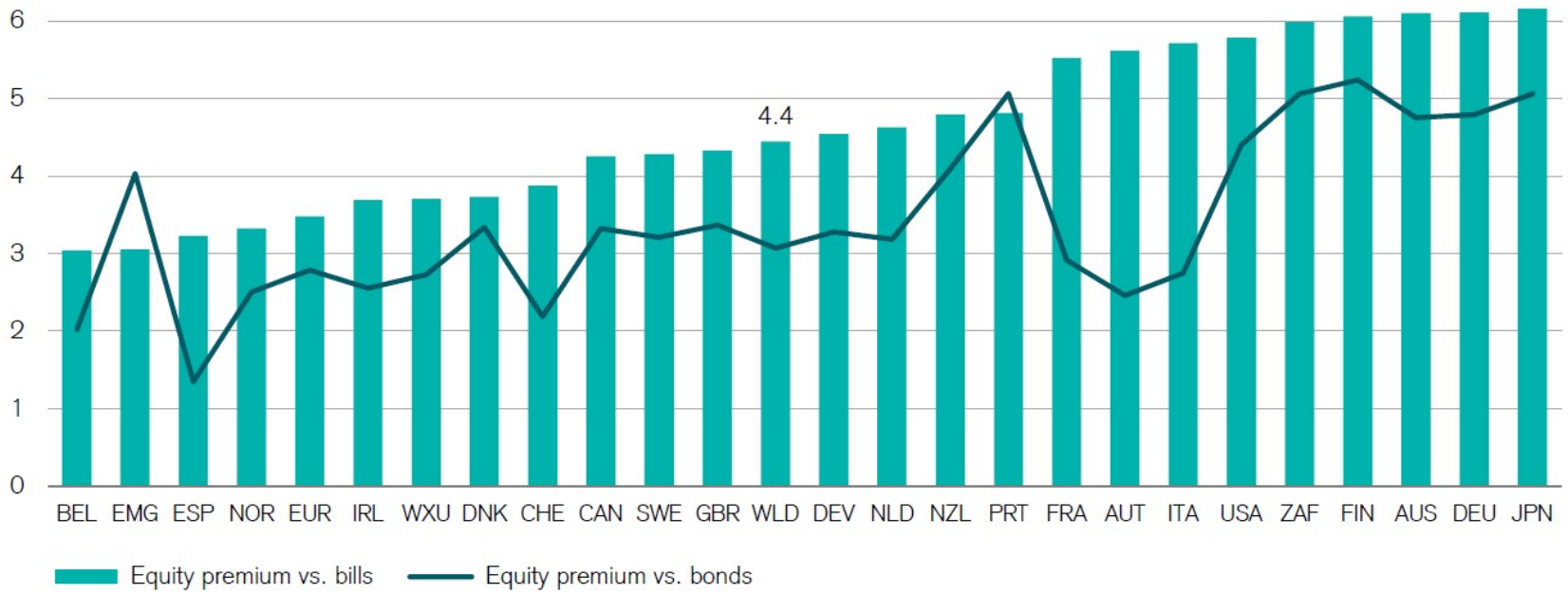


Damodaran Implied equity (market) risk premiums



See Useful Data Sets (nyu.edu) for Damodaran's data.
His 2020 and 2021 implied equity risk premiums for the US are 4.71% and 4.24% respectively.

Figure 11: Worldwide annualized equity risk premium (%) relative to bills and bonds, 1900–2020



Sources: Elroy Dimson, Paul Marsh and Mike Staunton, Triumph of the Optimists, Princeton University Press, 2002, and Global Investment Returns Yearbook, Credit Suisse, 2021. Not to be reproduced without express written permission from the authors.