Increasing Importance of Implied Volatility

Readers will remember that in the May, 2010, edition, I analyzed the "Slump Period" of 2010-3-26 to 2010-4-29, during which the FixedReset index declined by 3.93% (total return) with an increase in median weighted average yield for this index of slightly more than 120bp.

This analysis showed fairly conclusively that FixedResets do not trade on the basis of their expected yield-to-call; instead, it appears that its constituents are valued by the marketplace with an objective function comprised of two competing elements:

- Maximize Current Yield
- Minimize the potential capital loss given a call at par

In the August, 2010, edition I termed this the "Total Expected Loss" model and developed the "Expected Loss Rate" model, which divides the potential capital loss by the term remaining until the call date to arrive at an expected annual loss; the objective function is adjusted accordingly. It was found that fits were equally good, but that the Expected Loss Rate model had a peculiarity of its own: *The reason that this accounting does not result in yields being equal is that the accounting is not full: a 2% increase in Current Yield is associated with an approximately 3% increase in the Expected Loss Rate. If all correctly calculated yields-to-call were to be held more-or-less constant, the relationship would be 1:1.*

It was also shown that these two models both showed good correlation with the data commencing with the second quarter of 2009. In addition – and what I find very interesting – is that despite a wide range of market prices, the degree of risk aversion has been relatively constant over the past year (more so in the Expected Loss Rate Model, which is a point in its favour).

In this essay, I turn my attention to the pricing of PerpetualDiscounts. It will be remembered that this class and PerpetualPremiums form sub-types of the more general class Straights[1]:

Straights: All these issues will have call provisions of some kind, allowing the issuer to repay the money on certain dates or during a certain period and cancel the shares. They pay a fixed dividend until the issuer either calls them or defaults.

Perpetual Premium: comprised of all issues which do not have a mechanism whereby the shareholder can be assured of being repaid the capital on or by a certain date – if this ability did exist, the issue would be in the "Operating Retractible" market segment. All issues in this segment trade at a premium to their liquidation value, reflecting an annual dividend payment higher than the issuer would be required to pay for a new issue, but exposing the shareholder to a potential capital loss on redemption. The balance of risks on such issues can be a tricky thing to evaluate!

Perpetual Discount: These differ from the "Perpetual Premium" issues in that they trade at a discount to their liquidation value – the annual dividends are less than would be required on new issues from the same issuer. On the other hand, a buyer will pay less for them! Of all preferred share issues, these are the most exposed to "interest rate risk".

It is necessary to distinguish between the two groups because these two classes have very different risk/reward profiles with respect to changing levels of market interest rates.[2]

In the January, 2010, edition of this newsletter, I introduced the concept of Implied Volatility as a component in the relative value analysis of PerpetualDiscounts. This model uses Black-Scholes option theory[3] to value the option that is embedded in all extant issues of preferred shares.

In that issue I made available a Straight Perpetual Implied Volatility Calculator[4]. Extensive use will be made of this calculator throughout this essay.

The problem, as with all cases of investment instruments in which the issuer has an option embedded in the structure, is that the option places a limit on the amount an investor can gain, without placing any compensating limit (other than the amount paid for the investment) on the amount lost. If, for instance, we have a PerpetualDiscount issue paying dividends of $1.00 per annum and priced at $20 to yield 5%, the upper limit on the potential capital gains that can be reasonably expected is $5 per share. If market yields decline in the future, we may expect that the issue will be priced at $25 when yields are 4%, but we may not expect a price of $33 when yields are 3%: the issuer will be expected to call the issue at $25 and obtain financing at a lower yield.

This is all well and good, but the issuer is not expected to exercise the call if market yields increase: should they increase to 6%, we expect the investment to be priced at about $16.66; if yields increase to 10%, then our investment will have a market value of only $10. As market yields move arbitrarily higher, the investment value will be correspondingly reduced, with no lower bound – even though the credit quality and other investment characteristics of the issuer may not have changed.

The existence of the option makes the return profile of the instrument asymmetric: asymmetry is always a feature of fixed-income investment,[5] but a prudent investor will demand compensation for this element of risk. Just as we expect to receive increased yield on a corporate bond (compared to government bonds) to compensate for the potential that the issuer will default, we should also expect to receive increased yield to compensate for the potential that the issuer will call the investment for redemption.

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[1] For a description of each class of preferred share, see http://www.prefletter.com/whatPrefLetter.php, with a chart of the taxonomy available at http://www.prefletter.com/taxonomy.pdf

[2] See my article *Perpetual Hockey Sticks*, online at http://www.himivest.com/media/moneysaver_0703.pdf

[3] For an introduction to the theory, see Kevin Rubash, *A Study of Option Pricing Models*, available on-line at http://hilltop.bradley.edu/~arr/bsm/model.html (accessed 2010-10-7). Tony Paine has been investigating these option effects and suspects that a yield mean reversion model, as opposed to the random walk of the Black-Scholes model, may provide a better fit to the data in times during which the effect is not as pronounced as it is currently.

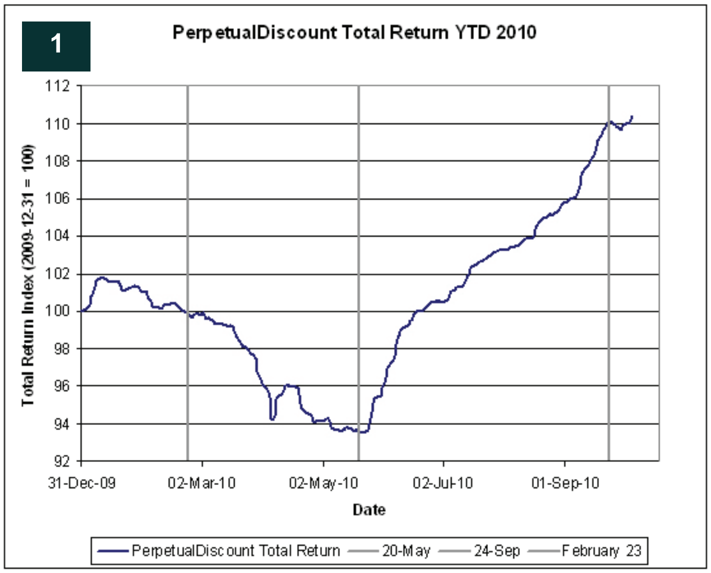
[4] Available on-line at http://www.prefblog.com/xls/PDTheoreticalPricing.xls. Updates will be announced from time to time via http://www.prefblog.com/?p=9733

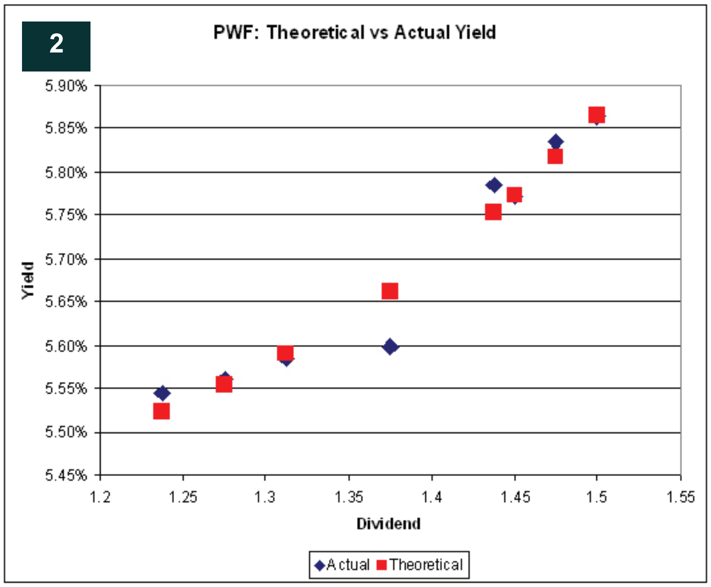
[5] For instance, when comparing a corporate bond to a government issue, the increased yield (say, 1% or 2% p.a.) is dwarfed by the potential loss on default (which might be as high as 100%)

The Summer Rally in PerpetualDiscounts

The performance of the preferred share market in general, and Perpetual-Discounts in particular, over the summer was extraordinary. From the market trough on May 20 to the recent peak on September 24, this section of the market gained 17.71% in total return with only six down days experienced in a total of eighty-seven trading days.

The two dates noted have been marked on Chart 1, which shows the total return of PerpetualDiscounts in the year-to-date, together with February 23, the date that the issue of GWO.PR.M was announced, this issue and its performance relative to other Straight Perpetuals issued by GWO, will be discussed later in this essay.





Implied Volatility Calculations

As an example of the Implied Volatility calculation, we can look at PWF issues on September 24, the end of the period. It is important that calculations be performed only on the shares of a single issuer; this means that not only are we eliminating heterogeneity in the sample due to differing credit quality, but we may also use Current Yield as our yield measure. This is not strictly accurate, but given that the all the ex-Dividend dates on the group's issues are identical it is a very minor error.

Details of the calculation are shown in Table 1, while the actual and theoretical Current Yields for the "best fit" are shown in Chart 2.

Table 1: Implied Volatility Calculation Results for PWF Straights, 2010-9-24

Ticker	Annual Dividend	Actual Closing Bid	Actual Current Yield	Pure Price*	Option Value*	Theoretical Value	Theoretical Current Yield
PWF.PR.E	1.375	24.58	5.60%	25.70	-1.42	24.29	5.66%
PWF.PR.F	1.3125	24.50	5.59%	24.53	-1.05	23.48	5.59%
PWF.PR.G	1.475	25.28	5.83%	27.57	-2.22	25.35	5.82%
PWF.PR.H	1.4375	24.85	5.78%	26.87	-1.88	24.99	5.75%
PWF.PR.I	1.50	25.58	5.88%	28.04	-2.46	25.57	5.87%
PWF.PR.K	1.2375	22.93	5.54%	23.13	-0.73	22.41	5.52%
PWF.PR.L	1.275	22.93	5.56%	23.83	-0.87	22.96	5.55%
PWF.PR.O	1.45	25.12	5.77%	27.10	-1.99	25.11	5.77%

**Theoretical calculations were performed using a "Pure Yield" (of a theoretical non-callable PWF Straight Perpetual) of 5.35%, Volatility of 14% and an Option Term of 3 Years. These are the 'best fit' parameters: Option Term was held constant while Pure Yield and Volatility were varied to minimize the squared error between the actual and theoretical price.*

Theoretical Problems with the Calculation

There are a number of problems. Most obvious is the necessity of specifying an Option Term for the Black-Scholes equation, when in fact the call at par is of infinite term and becomes exercisable after a given date. However, I am not aware of any option theory that explicitly allows for this type of option; presumably, given a random, unbounded walk of prices of the underlying security, such an option would have infinite value.

A proper theory of options to analyze the situation would, probably, emphasize a lower bound of possible market yields (zero percent is commonly accepted as such a lower bound, but US Treasury Bills violated this boundary quite often during the Panic of 2007). Additionally, the theory would incorporate the issuer's cost of carry, issuance costs and option lock-out periods in an explicit manner. For instance, say there is an issue outstanding with a coupon of 5.50% at a time when market yields are 5.00%. Standard option theory will assume the exercise of the option as automatic on the call date, even after considering issuance costs equivalent to 0.20%, but the infinite duration of the embedded option complicates matters.

If the issuer calls the issue, it will refinance at 5.00% and the new instrument will also have an embedded call. Thus, one would expect the issuer to exercise the new call should market yields decline to 4.50%. However, there is the chance that market yields will decline to this point during the option lock-out period: most Straights are issued with terms such that a call at par is not possible until nine years after issuance (calls at a premium are generally possible after five years). Additionally, there is the consideration that the eventual refinancing at 4.50% when done in this manner will involve two sets of refinancing charges.

Thus, when market yields reach 5.00%, the issuer must make a decision: should it refinance immediately, with a subsequent black-out period and refinancing costs? Or should it leave the 5.50% issue outstanding in the hopes of refinancing at an even lower rate in the near future? And, importantly, how does one express this choice in a satisfyingly rigorous mathematical way?

I don't know the answer and am insufficiently familiar with the more arcane aspects of option theory to know if anybody has even considered the problem. I bet there's potential for a master's thesis in the question!

Data Problems with the Theory

There are several data elements that have been ignored in this very simple model of Implied Volatility.

Primarily, we are ignoring the precise time at which an option becomes exercisable. Many issues are currently in their lock-out or premium call period[6] and although all will become callable at par eventually, the term until this par call is important.

Secondarily, we are ignoring liquidity effects, as shown in Table 2 for GWO.

Table 2: Two Liquidity Measures for GWO Straights

Ticker	Average Daily Trading Value, Thousands of Dollars, 2010-9-24	Average Closing Quotation Spread 2010-10-8
GWO.PR.F	54	0.10
GWO.PR.G	288	0.06
GWO.PR.H	206	0.19
GWO.PR.I	199	0.08
GWO.PR.L	156	0.16
GWO.PR.M	129	0.07

There are many, many ways to measure liquidity, and investors of different types may choose to emphasize different measures. For example, a retail investor seeking to trade a maximum of a few hundred shares at a time may be interested in the average price spread between the bid and the offer. A larger investor may be more interested in the Average Trading Value. An enormous investor might wish to ignore all "small" trades and measure liquidity according to the number of blocks in excess of 10,000 shares traded through the Exchange.[7] Others might wish to gauge liquidity according to issue size. Different measures will lead to different rankings of the liquidity of issues, but the point is that liquidity is valuable and thus more liquid issues should trade at a lower yield than similar less liquid issues. This refinement is missing completely from the Implied Volatility calculation discussed in this essay.

Thirdly, we are assuming that the issues examined are homogeneous in all aspects other than annual dividend. Two sources of heterogeneity have been discussed above, but the potential for variance is infinite; one issue might have provisions (specified in its prospectus) that are significantly different from the others.

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[6] See the appendix to the July, 2010, edition of this newsletter for more discussion of this point.

[7] Not as good a method as it has been, with the advent of algorithmic trading allowing investors to execute large trades in small pieces automatically.

Consistency Problems with the Theory

An additional problem with the theory – although some might wish to consider it a strength! – is that no boundaries were imposed on the variables when fitting the theory to the data. There is not even a preference applied to the variables; the only element considered when selecting the best fit is the squared-error between the theoretical and actual prices.

As is usual when mathematics is allowed to run amok, this can lead to absurd results, as shown in the data for GWO issues on 2010-9-24, which is presented in Chart 2 and Table 3. These results are particularly galling since, of course, PWF is the parent company of GWO, so one might presume that the behaviour of their Straight Preferreds would be very similar. One's presumption would be wrong.

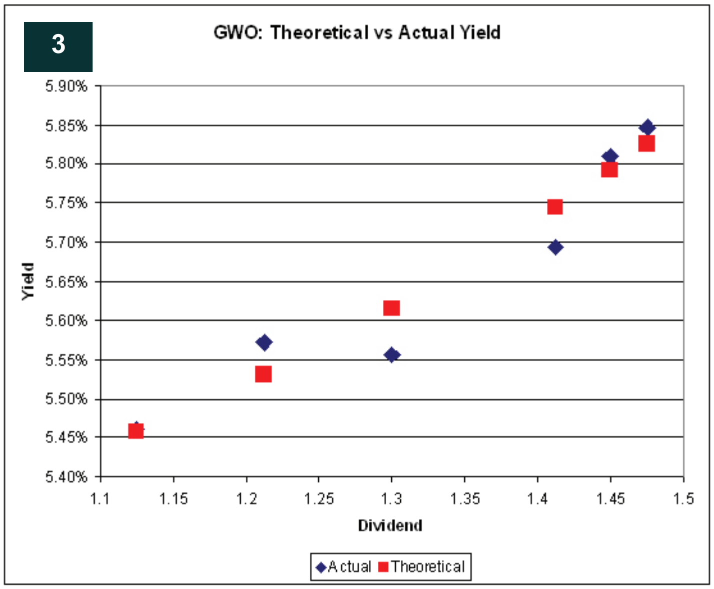
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Table 3: Implied Volatility Calculation Results for GWO Straights, 2010-9-24

Ticker	Annual Dividend	Actual Closing Bid	Actual Current Yield	Pure Price*	Option Value*	Theoretical Value	Theoretical Current Yield
GWO.PR.F	1.475	25.23	5.85%	40.86	-15.54	25.32	5.83%
GWO.PR.G	1.30	23.40	5.56%	36.01	-12.86	23.15	5.62%
GWO.PR.H	1.2125	21.76	5.57%	33.59	-11.67	21.92	5.53%
GWO.PR.I	1.125	20.60	5.46%	31.16	-10.55	20.61	5.46%
GWO.PR.L	1.4125	24.81	5.69%	39.13	-14.53	24.53	5.74%
GWO.PR.M	1.45	24.96	5.81%	40.17	-15.13	25.04	5.79%

**Theoretical calculations were performed using a "Pure Yield" (of a theoretical non-callable GWO Straight Perpetual) of 3.61%, Volatility of 27% and an Option Term of 3 Years. These are the 'best fit' parameters: Option Term was held constant while Pure Yield and Volatility were varied to minimize the squared error between the actual and theoretical price.*

There will always be some who insist that the mathematically derived figures make objective sense, but the numbers are difficult to rationalize. We are asked to believe that GWO could issue a non-callable Straight Perpetual at 3.61%, while PWF would have to pay 5.35%; a difference of this magnitude is simply not credible. Importantly, however, the Implied Volatility for the PWF calculation is 14%, while a figure of 27% is derived for GWO.

One might argue that, since these numbers reflects the yield volatility of a non-callable Straight Perpetual, it simply reflects a belief that while GWO is currently a far better credit than PWF, it is also far more volatile. I cannot say I would grant such arguments a particularly sympathetic hearing.

Rich-Cheap Analysis with Constant Volatility

It seems sensible to specify that the volatility in the calculation should be held constant. We can then vary the Pure Yield to minimize fitting error and use the differences between the constrained theoretical fit and the actual prices as an element of Rich-Cheap analysis. After all, our problem isn't whether or not we can arrive at a theoretically valid explanation of the data, although this is a step on our way; ultimately, we want to determine which issues to buy and sell, leaving the business school professors to shake their fists at our passing Porsches from their tenement garrets.

Accordingly, the analysis for GWO Straights as of 2010-9-24 was repeated; this time with the constraint that Volatility was held at 14%, the same as was found through the best-fit analysis of PWF. Results are shown in Chart 4 and Table 4.

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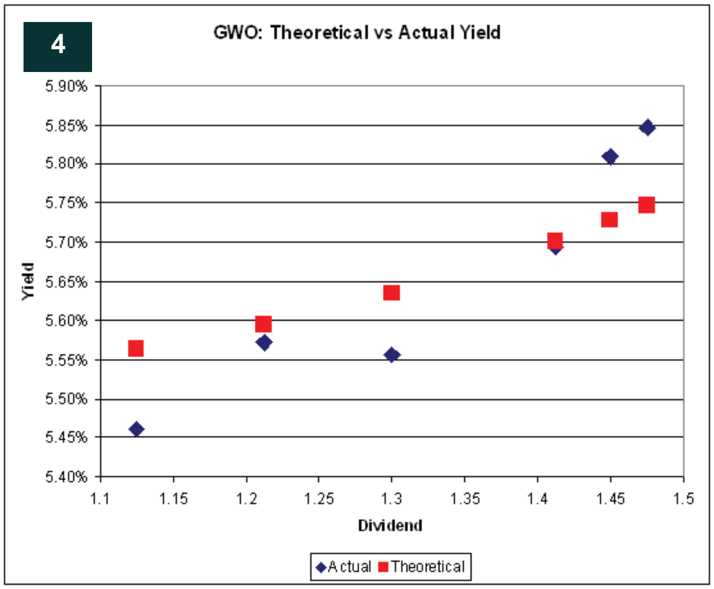


Table 4: Implied Volatility Constrained Calculation Results for GWO Straights, 2010-9-24

Ticker	Annual Dividend	Actual Closing Bid	Actual Current Yield	Pure Price*	Option Value*	Theoretical Value	Theoretical Current Yield	Rich/ (Cheap)
GWO.PR.F	1.475	25.23	5.85%	27.62	-1.96	25.66	5.75%	(0.43)
GWO.PR.G	1.30	23.40	5.56%	24.34	-1.27	23.07	5.63%	0.33
GWO.PR.H	1.2125	21.76	5.57%	22.71	-1.03	21.67	5.59%	0.09
GWO.PR.I	1.125	20.60	5.46%	21.07	-0.84	20.22	5.56%	0.38
GWO.PR.L	1.4125	24.81	5.69%	26.45	-1.67	24.78	5.70%	0.03
GWO.PR.M	1.45	24.96	5.81%	27.15	-1.84	25.32	5.73%	(0.36)

**Theoretical calculations were performed using a "Pure Yield" (of a theoretical non-callable GWO Straight Perpetual) of 5.34%, Volatility of 14% and an Option Term of 3 Years. Only "Pure Yield" was varied.*

It will not have escaped notice that although the "Pure Yield" difference between PWF and GWO is almost eliminated when volatilities are constrained to be equal (Pure Yields are calculated to be 5.35% and 5.34%, respectively), this is not necessarily a good thing. Another method of performing a rich-cheap analysis of these two series of issues would be to determine – perhaps arbitrarily, perhaps through the analysis of other data – a single benchmark "Pure Yield" for the calculation and constraining all three parameters in the fitting. One might take a view on relative credit quality and, say, set the GWO Pure Yield at 10bp less than the PWF Pure Yield.

Lynx-eyed readers of this newsletter will also note that I have recommended GWO.PR.I as a PerpetualDiscount, despite the fact that the analysis of Table 4 indicates that this issue is Rich. All I can say to that is that Implied Volatility analysis is only part of the puzzle and a great many considerations compete with each other in the determination of overall value.

The trouble with quantitative analysis is that as soon as you have a "good" system, it is instantly obvious that many refinements are possible!

The Summer Rally and Volatility

The overall level of market prices should not be a primary determinant of the volatility – after all, volatility merely quantifies the degree of future variability of price. In fact, implied volatility should have declined somewhat with the increase in market prices – options markets generally show a "volatility smile" (a symmetric increase in implied volatility the further that market price is from strike price) or a "volatility smirk" (descriptive of a situation in which this increase is apparent only when the options are out of the money).

But this is the Canadian preferred share market, which has its own special way of doing things. Table 5 shows the evolution of the "best fit" parameters through the period of the summer rally.

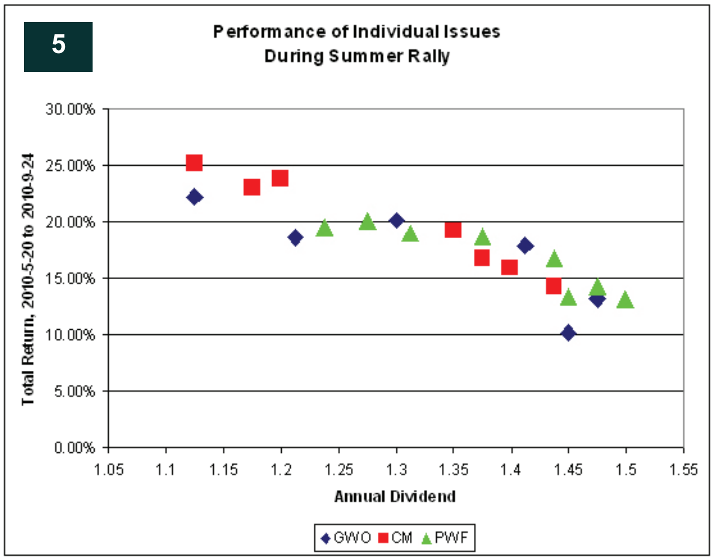
Perhaps the most striking observation possible from a scan of Table 5 is that it was possible to buy deeply discounted CM Straight Perpetuals without giving up yield even at the beginning of August. I do not believe that such a thing can be rationally explained; perhaps it was due to a lingering perception that CM is a weak bank, that would not redeem its Straights under any circumstances; if this is correct, then a corollary might be that GWO is perceived as being very aggressive in redeeming its higher-coupon issues.

Table 5: Changes in Implied Volatility "Best Fit" Parameters through Summer Rally						
Date	**GWO Pure Yield**	**GWO Volatility**	**CM Pure Yield**	**CM Volatility**	**PWF Pure Yield**	**PWF Volatility**
2010-5-23	6.40%	1%	6.32%	1%	6.55%	1%
2010-6-4	6.19%	12%	6.08%	0%	6.20%	9%
2010-6-18	6.01%	10%	5.90%	7%	6.00%	6%
2010-7-5	5.98%	10%	5.95%	1%	5.98%	9%
2010-7-19	5.88%	10%	5.83%	1%	6.04%	1%
2010-8-3	5.78%	12%	5.77%	1%	5.88%	10%
2010-8-17	5.50%	16%	5.67%	6%	5.85%	9%
2010-8-31	5.39%	17%	5.42%	12%	5.84%	9%
2010-9-15	4.53%	23%	5.08%	15%	5.62%	11%
2010-9-24	3.61%	27%	4.83%	18%	5.35%	14%

The Summer Rally and Individual Issue Performance

Given the very low volatility at the beginning of the period and the very high volatility at the end, it should be clear that lower coupon issues will have outperformed; one way to think of this is that they will have received a similar benefit from the decline in Pure Yield, but will have experienced a less negative effect from the change in the value of their embedded options.

This thought is borne out by the relative performance of these issues during the Summer Rally, illustrated in Charts 5 and 6.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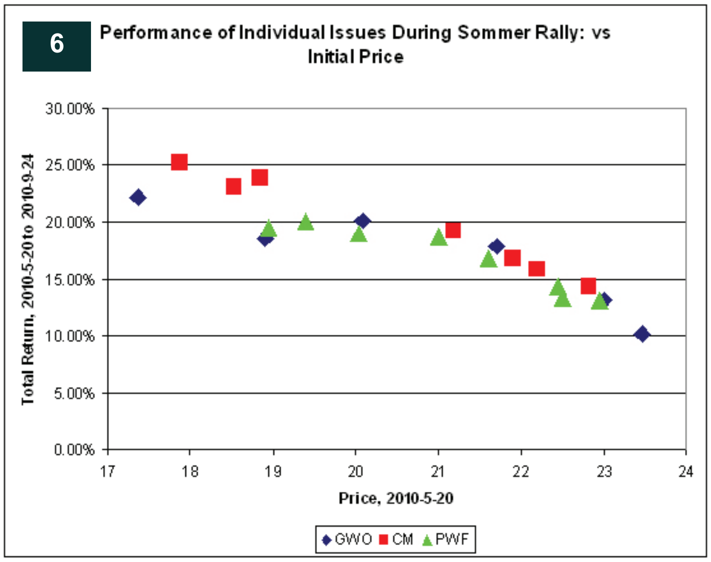
Performance of Individual Issues During Summer Rally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Performance of Individual Issues During Sommer Rally: vs Initial Price

These differences are all the more dramatic given the initial value of Implied Volatility of near zero: these issues all had the same downside risk in the event of yield increases, since their initial yields were similar. Implied Volatility can never be a negative number.

I will certainly agree that at the trough on May 23, with most issues trading well below their call price, the chance of call probability becoming important appeared remote. However, a prudent portfolio manager will consider all possibilities; and in this case, a relative over-weighting in low-coupon, low-priced issues would not have cost anything at all, either in yield or downside risk. However, imprudent portfolio managers have received their come-uppance: selecting issues which underperform their peers by 10% over a four month period is not particularly helpful to portfolio returns.

Credit Stratification

It has been a very useful feature of the FixedReset market over the past two years that the degree of Credit Stratification[8] is minimal. Credit Stratification, which became a feature of the PerpetualDiscount sector only during the Panic of 2007, refers to the different market perceptions of credit quality within issues having an identical DBRS Credit Rating. Such stratification does not necessarily imply the repudiation by the marketplace of DBRS' credit ratings: it is recognized that each notch represents a broad band and there is plenty of room for differentiation within that band. However, the FixedReset market does not display any noticeable degree of stratification; all issues rated Pfd-1(low) can be treated as a homogeneous group for analytical purposes.

It is tempting, therefore, to attempt to replicate the analytical treatment of FixedResets that has proved successful in relating the difference in Current Yields of the issues to their difference in price. After all, I have grave doubts that the retail-dominated Canadian preferred share market contains a significant number of players who carefully calculate Implied Volatility and use it as an analytical tool to select their specific investments. If there are a significant number of such players, they must have started doing this since May, when the Implied Volatility was nearly zero!

It seems more likely that investors who give any thought to the matter will reason more along the following lines: a lower-coupon, lower-price PerpetualDiscount has more chance for a capital gain than one with higher-coupon, higher price. Therefore, additional yield is required for the latter type to ensure that the weighted expected return over all possible interest rate scenarios is the same for instruments of similar risk – which is what the Efficient Market Hypothesis zealots would have us believe is always the case.

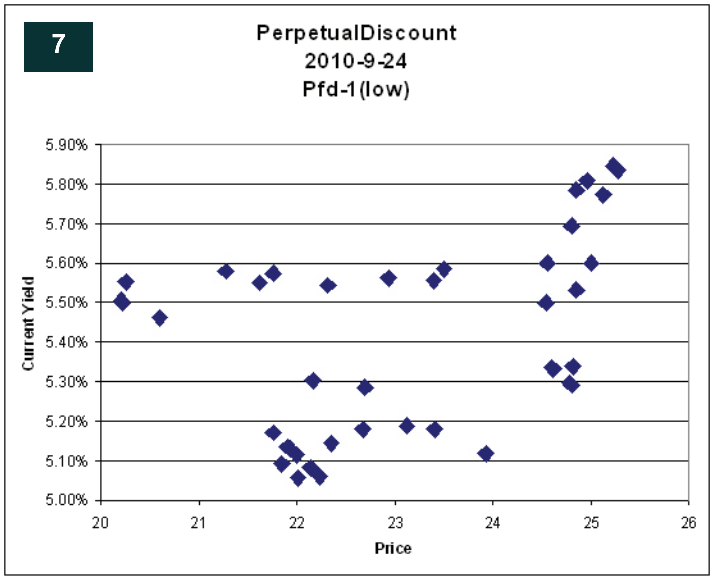
This rationale is not as firmly founded as the FixedReset rationale, since we are considering only the possibility of a capital gain for PerpetualDiscounts, versus the virtual certainty of a capital loss on the call date for FixedResets trading at a premium (since it may be assumed that issues that are not called will trade at a discount to par). However, the possibility of such a symmetrical relationship in the market's analysis of these issues is sufficiently high that it should be tested.

Unfortunately, Chart 7 shows such a poor relationship between Current Yield and Price for PerpetualDiscount issues rated Pfd-1(low) that readers might be forgiven for harbouring suspicion that the other charts and table in this essay have been mere sleight of hand, revealing merely that the category of investment management newsletters be added to the trinity of "lies, damned lies and statistics". There is a correlation, but it is very poor with an Adjusted R-Square of only 13% and a slope in the relationship of 6bp per dollar.

However, the problem can be explained by credit stratification: the Pfd-1(low) PerpetualDiscounts do not form a homogeneous group and cannot be treateden bloc as if they were well-behaved FixedResets. Chart 8 shows disaggregated data for four issuers, while Table 6 reports the results of correlation analysis.

Table 6: Results of Regressions, Current Yield vs. Price, 2010-9-24, by Issuer

Issuer	Issues	Adjusted R-Square	Intercept	Slope (basis points per dollar)
CM	6	0.95	2.73%	11
GWO	6	0.78	3.96%	7
PWF	7	0.73	3.43%	9
RY	8	-0.09	4.82%	1



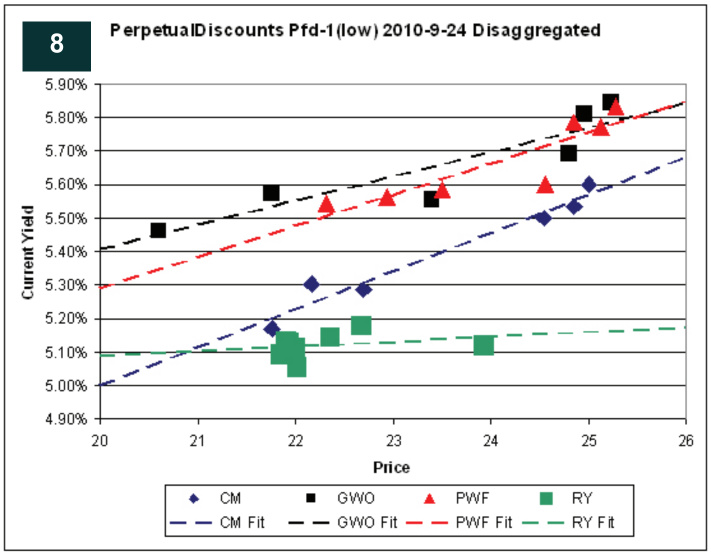


Chart 8 suggests a pop-quiz to test readers' comprehension of the material so far. Should RY.PR.W, trading at about $24, be considered rich or cheap relative to other RY issues according to Implied Volatility theory? You have thirty seconds.

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[8] See my article *Credit Stratification*, available on-line at http://www.himivest.com/media/moneysaver_0806.pdf

An Inconsistency: Regime Shifting?

A surprising feature of the regressions reported in Table 6 is that GWO has the flattest slope of the three issuers that have been featured throughout this essay. This is precisely the opposite of our expectations given the very high Implied Volatility that was calculated for this issuer.

Fortunately, however, close inspection of Chart 8 leads us to a hypothesis that does not just explain the apparent inconsistency of the September 24 data analysis, but also provides an explanation of the huge increase in volatility throughout the Summer Rally.

We see not only that GWO has the two lowest-priced issues in the sample (GWO.PR.H and GWO.PR.I; see Table 4), but that these two issues serve to flatten the regression line illustrated in Chart 8. We also see that RY, which has the lowest-priced upper bound of its sample (RY.PR.W at 23.93), also has the flattest regression line of any of the four issuers shown in Chart 8. Finally, we note that at the beginning of the Summer Rally, when the highest priced issue amongst the 21 issues in the GWO/PWF/CM sample was GWO.PR.M at 23.47, Implied Volatility was essentially zero (see Table 5).

We therefore hypothesize that market-yield volatility and the prospect of calls is not considered analytically useful by the marketplace until a certain threshold is reached. When that threshold is breached, the market commences applying an Implied Volatility of about 15%.

Naturally, this is a rather silly thing for the market to be doing; it is always possible for market yields to vary in the future and it is always more likely for some issues to be called than for other issues. The difference between call probabilities for high-coupon issues relative to low-coupon issues is always one of degree, not of existence. Investors who ignored this truism and invested in May, 2010, with the idea that all issues were equally likely to be called have learned to their cost (Charts 5 and 6) that violent changes in market yields can occur at any time and the potential for violent change should never be forgotten.

Effective Modified Duration

We are now in an environment of high Implied Volatility and this has an important effect on the risk/reward profile of PerpetualDiscounts priced proximate to par.

As shown in Table 7, a change to the "Pure Yield", considered to be the fair yield of a non-callable perpetual annuity of PWF has a widely varying effect on the theoretical price, depending upon the assumed annual dividend of the callable PerpetualDiscount.

Table 7: Effective Modified Duration for PWF Straights as of 2010-9-24

Ticker	Annual Dividend	Pure Price	Option Value	Theoretical Value	Perturbed Pure Price	Perturbed Option Value	Perturbed Theoretical Value	Percent Change	Effective Modified Duration
PWF.PR.E	1.375	25.70	-1.42	24.29	25.23	-1.18	24.04	-1.03%	10.3
PWF.PR.F	1.3125	24.53	-1.05	23.48	24.06	-0.88	23.21	-1.15%	11.5
PWF.PR.G	1.475	27.57	-2.22	25.35	27.06	-1.91	25.16	-0.75%	7.5
PWF.PR.H	1.4375	26.87	-1.88	24.99	26.38	-1.81	24.77	-0.88%	8.8
PWF.PR.I	1.50	28.04	-2.46	25.57	27.52	-2.13	25.39	-0.70%	7.0
PWF.PR.K	1.2375	23.13	-0.73	22.41	22.71	-0.60	22.11	-1.34%	13.4
PWF.PR.L	1.275	23.83	-0.87	22.96	23.39	-0.72	22.67	-1.26%	12.6
PWF.PR.O	1.45	27.10	-1.99	25.11	26.61	-1.70	24.90	-0.84%	8.4

**Theoretical calculations were performed using a "Pure Yield" (of a theoretical non-callable PWF Straight Perpetual) of 5.35%, Volatility of 14% and an Option Term of 3 Years, identically to the calculation shown in Table 1. These calculations were perturbed by increasing the Pure Yield by 10bp to 5.45%. Percent Change is the percentage change from Theoretical Value to Perturbed Theoretical Value.*

It may be seen that although an increase of 10bp in the Pure Yield makes the value of the perpetual annuity less positive, it also makes the value of the issuer's option to call the issue less negative. This results in a change in the theoretical price of the instrument that is much less than might otherwise be expected; These changes are reflected in the Effective Modified Duration of each instrument, which I have previously discussed.[9]

The Effective Modified Duration can be compared with the Modified Duration[10] of a normal, non-callable bond with a maturity date. If a par bond with a yield of 5.1% has a term of nine years, its duration is 7.1. If its term is twenty-three years, its modified duration is 13.4.

To put it another way, the weighted average Modified Duration of the BMO Long Corporate Bond Index ETF (Symbol ZLC)[11] is 12.29 The weighted average Modified Duration of the BMO Mid Corporate Bond Index ETF (Symbol ZCM)[12] is 5.89.

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[9] See the January, 2010, edition and my article on Modified Duration at http://www.himivest.com/media/moneysaver_0705.pdf

[10] See the function MDuration() in Microsoft Excel, for instance

[11] See http://www.etfs.bmo.com/bmo-etfs/holdings?fundId=75747

[12] See http://www.etfs.bmo.com/bmo-etfs/holdings?fundId=75744

However, one should be cautious when utilizing the Effective Modified Duration calculation of Table 7, since the Effective Modified Duration will change in response to changing levels. The change in duration with changing price is referred to as convexity.[13]

On the other hand, it will be noted that the option value embedded in the prices of these instruments is quite considerable. This value serves to buffer the instruments against extreme market declines; this effect was quite noticable at times during the Panic of 2007. When we get another large decline, I'll write another essay showing the effect. Ideally, Implied Volatility will remain constant at that time; but until then readers will have to make do with looking at charts 5 and 6 upside down.

Thus, the higher coupon issues may be considered to be a more defensive investment than the lower coupon issues, as their total return is less sensitive to changes in market yields. It should be noted that this calculation is dependent upon a constant level of Implied Volatility and that if Implied Volatility were zero[14] there would be no difference in the interest-rate sensitivity of these instruments and all their yields would be the same.

It should also be remembered that in times of stress, just about anything can happen. In June, 2008, the relationship between coupon and yield inverted; low-coupon issues had a higher yield than high-coupon issues. June 2008 was a very silly month.[15]

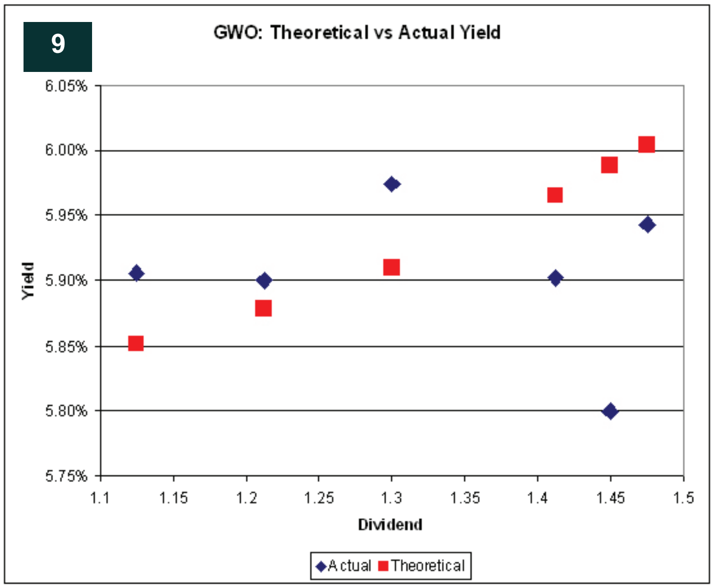
New Issue Effects: The Story of GWO.PR.M

On February 23, 2010, Great-West Lifeco announced[16] an issue of Straight Preferreds with a coupon of 5.8%. All terms of this issue were standard. On that date, GWO issues were trading as shown in Table 8 and diagrammed in Chart 9.

Table 8: GWO Straight Perpetuals at Time of GWO.PR.M Issue Announcement

Ticker	Dividend	Bid Price	Current Yield	Theoretical Current Yield*	Theoretical Price*
GWO.PR.I	1.125	19.05	5.91%	5.85%	19.22
GWO.PR.H	1.2125	20.55	5.90%	5.88%	20.63
GWO.PR.G	1.30	21.76	5.97%	5.91%	21.99
GWO.PR.L	1.4125	23.93	5.90%	5.97%	23.68
GWO.PR.M	1.45	25.00 [Issue Price]	5.80%	5.99%	24.21
GWO.PR.F	1.475	24.82	5.94%	6.00%	24.56

**The theoretical values were derived using Volatility constrained to be the recommended 15%; Years constrained to be 3. Pure Yield was varied to minimize the squared error of the issues other than GWO.PR.M.*



The raw data for these issues show that Volitility is arbitrarily close to zero, but I have prepared the theoretical values by constraining this attribute to be 15%. This illustrates the difference between a Pricing Model, which seeks only to explain the current level of market prices, and a Valuation Model, which seeks to predict relative future performance.

It does not take any great insight into the market to see that GWO.PR.M was aggressively priced; after all, an issue with a slightly higher annual dividend was trading below par at the time. However, some might be surprised at the degree of the aggressive pricing: the entirely reasonable theoretical model shows that such an issue should have been priced at 24.21, not 25.00; or, alternatively, should have carried a coupon well in excess of 5.80% – in fact, varying the coupon payment until the theoretical price is 25.00 shows that an annual payment of 1.507, or about 6.03%, is required[17]. Even at that level, the price would only have been "fair": a new issue concession would normally be expected to induce customers to allocate more money to the preferred share market.

At the time, however, the market was ignoring volatility and markets rose. The total returns of these issues from the GWO.PR.M announcement date to the end of the Summer Rally is shown in Table 9.

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[13] See http://www.himivest.com/media/moneysaver_0711.pdf

[14] Or, to be more precise, arbitrarily close to zero since the calculations blow up if it is equal to zero

[15] See http://www.himivest.com/media/moneysaver_0809.pdf

[16] See http://www.greatwestlifeco.com/web5/groups/common/@public/documents/web_content/s7_009672.pdf (accessed 2010-10-10)

[17] I remarked at the time at how expensive the issue was, but nobody listened to me. Nobody ever listens to me. See http://www.prefblog.com/?p=9821

Table 9: GWO Performance since GWO.PR.M Announcement Date

Issue	Annual Dividend	Total Return*, 2010-2-23 to 2010-9-24
GWO.PR.I	1.125	13.12%
GWO.PR.H	1.2125	10.74%
GWO.PR.G	1.30	12.50%
GWO.PR.L	1.4125	8.48%
GWO.PR.M	1.45	3.39%
GWO.PR.F	1.475	6.39%

**Total return has been calculated assuming the reinvestment of dividends at the bid price on the ex-Dividend dates of 2010-5-31 and 2010-8-31. The issue price of 25.00 has been used as the starting bid price for GWO.PR.M*

Obviously things have worked out very poorly for the purchasers of the new issue; they may not even find consolation in the idea that the ordering of returns would have been reversed had the market declined, since the Implied Volatility of (essentially) zero on the announcement date means that there was no negative effect on that day's prices which would have offset the decline in price due to increases in Pure Yield.

Volatility can be ignored only at one's peril!

New Issue Structures suggested by the data:

The new importance of Implied Volatility in the market for Straight Perpetuals brings with it the potential for issuers to tailor their offerings to reflect the new biases of investors.

While it is probably asking too much to hope for a true Perpetual, with no calls allowed by the issuer at all, there are two other adjustments to the structure that would be well received by investors at this time.

The first would be a long lock-out period for calls. The standard structure of a Straight Perpetual allows for its call after five years at $26, which declines by 0.25 annually until it becomes callable at par nine years after issue and forever afterwards. Given the new concern about potential calls, there is the possibility that a longer lock-out period would allow issuers to attach a lower annual dividend to their issuance than would otherwise be the case. Against this hypothesis, however, is the fact of the existence of the standard FixedReset structure, which has a call at par after only five years – and, amazingly, a high proportion of the populace feels that this is a good thing!

Another possibility is for issues to have no fixed-price call at all; it would only have a "Canada Call". In such a structure, there would be relatively short lock-out period, but the issue might be callable at a price which reflected the Government of Canada thirty year bond. For instance, an issue might carry a coupon of 5%, and be callable at the Government of Canada Thirty Year Rate plus 100bp. Such a bond now yields 3.40%,[18] so the call yield would be 4.40% and the call price would be $25 * 5.0 / 4.4 = 28.41. As the GOC-30 yield changed, the call price would change as well; if GOC-30 reached 9%, the call yield would be 10% and the call price would be $12.50, a mere one-half of issue price. However, in such an environment of high yields, the relatively low spread would make it almost certain that the call price would be above the market price of the issue.

Other Investment Implications

Heretofore I have treated Implied Volatility as a magic number – it comes out of option theory, albeit with problems as discussed, and is then used without question.

But when doing any analytical work we must question our assumptions; one method of dong this is to examine the distribution of future market yield scenarios that arise from the calculations and, perhaps, take a view on the likelihood of their occurance.

Chart 9 shows the probability of each future interest rate scenario as determined by the calculations for PWF on 2010-9-24, described in Table 1 and Chart 2. We see that the calculation implies a very significant probability of the market level of Pure Yield being below 4.5% in the next three years, which would mark an historic new low.

This is perhaps better illustrated by Chart 10, which shows the cumulative probability for PWF and compares it to the similar, unconstrained, calculation for GWO which was described in Table 3 and Chart 3. Those who feel that the projected probability distribution is unreasonable may well seek to adjust their portfolio to exploit potential gains as the market's view gradually shifts to coincide with their view. If one feels that volatility is too high, for example, higher coupon issues trading near par would be favoured.

Be wary, though! Taking a view on volatility is not as intuitively easy as taking a view on market direction; and taking a view of any kind is fraught with danger, as discussed in the Market Timing essay published as the appendix to the September, 2009, edition of this newsletter.

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[18] See http://www.canadianbondindices.com/live_data.asp

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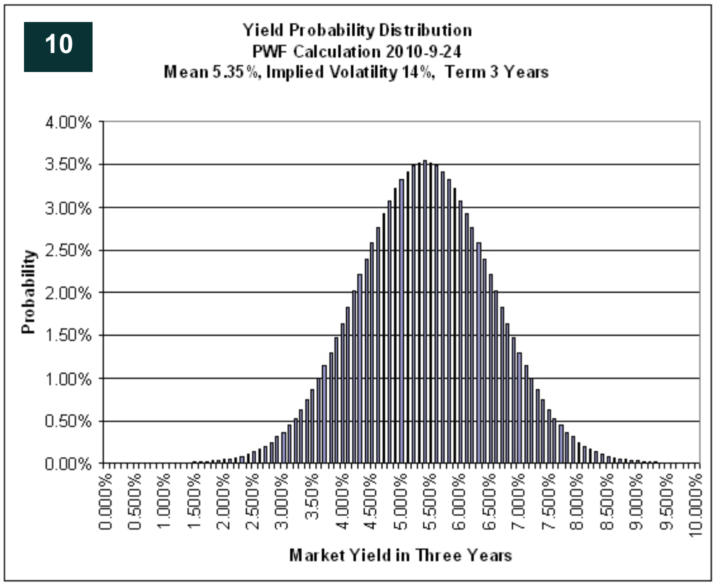

Yield Probability Distribution
PWF Calculation 2010-9-24
Mean 5.35%, Implied Volatility 14%, Term 3 Years

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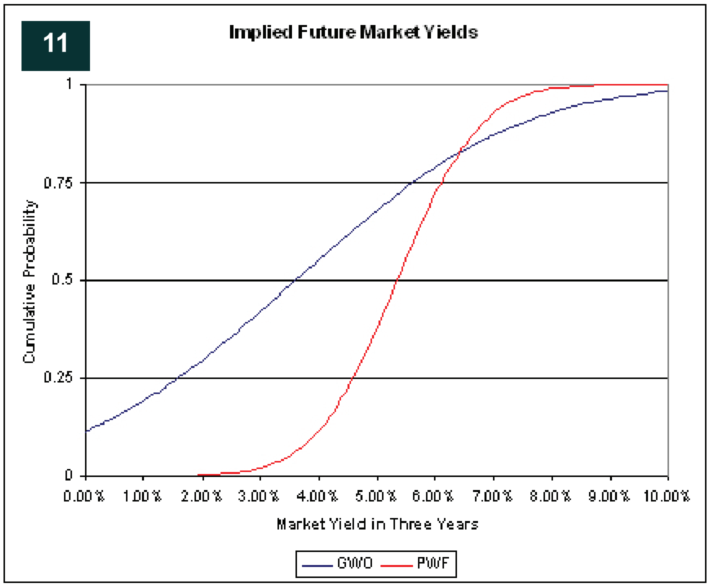

Implied Future Market Yields