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Draft

P/E's and Pension Funding Ratios

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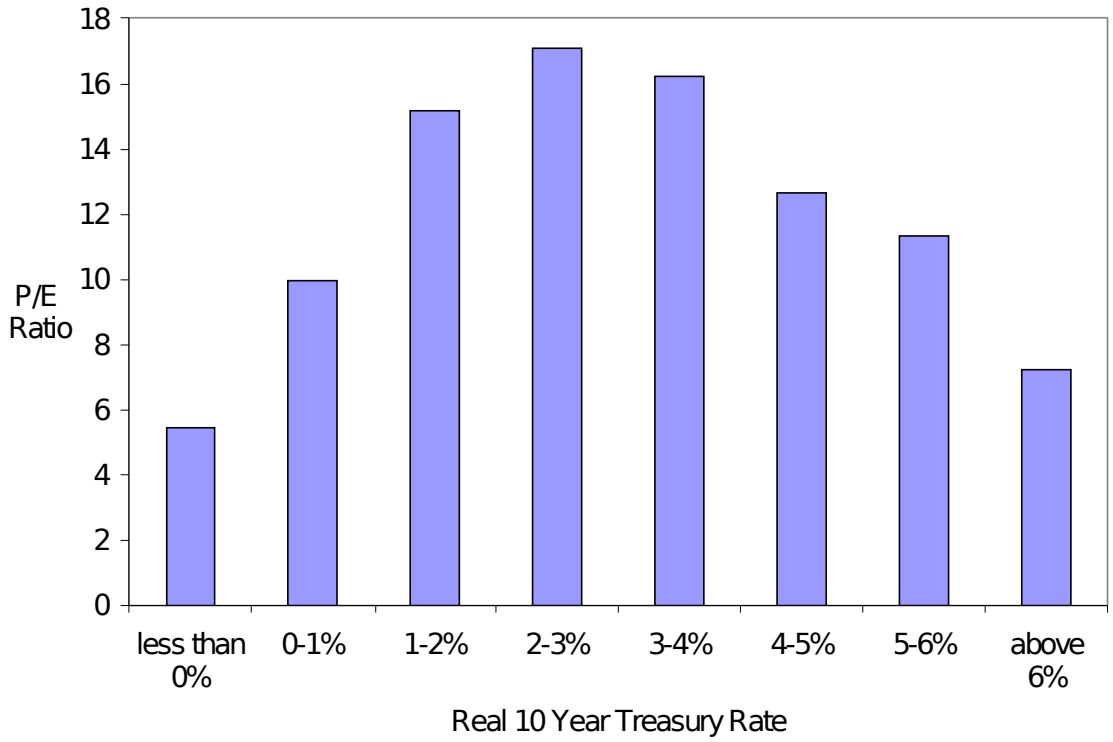
There is some evidence for the intriguing conjecture that P/E ratios may decline under both significantly lower as well as significantly higher real rates. The P/E response pattern would then resemble a flat-top tent that angles downward at both ends. For pension liabilities defined in real terms, very low real rates would then lead to a cliff-like falloff in the funding ratio from the decline in equity valuations combined with surging liability costs. This paper explores the risk implications of such a low rate scenario and the equity valuations that could give rise to such a tent pattern.

The P/E Tent

A number of historical studies of price/earnings (P/E) ratios for US stocks have exhibited generally declining P/E's as a function of higher nominal interest rates. A different perspective can emerge when real rates are substituted for nominal rates. The histogram in Exhibit 1 is based on monthly samples over the period 1978 to 2004. The P/E's were computed from 12-month forward earnings projections while the real rates were derived by subtracting concomitant inflation from 10-year Treasury rates. This pattern contrasts with the typical decreasing pattern of P/E ratios with nominal interest rates. In place of P/E declining with nominal rates, the highest P/E's for real rates lie within a "sweet spot" of 2-3%, and then fall off for both higher — and lower — rate levels. Thus, for this particular historical period, rather than the monotonic decline seen with nominal rates, the P/E ratios appear to exhibit a "tent pattern" relative to real rates.

In this paper, with due recognition of the many empirical limitations, we proceed on an admittedly conjectural basis to explore the potential implications that such a tent pattern would have for the asset/liability management of pension funds and for some aspects of asset valuation in general.

Exhibit 1
Histogram of Real Rate vs. P/E Ratios 1978-2004



Source: Morgan Stanley Research

One potential explanation for the tent diagram relates to the interaction of real rates and growth prospects. For real rates in 2-3% sweet spot, economic and profit growth might be presumed to be reasonably normal, reflecting a comfortable balance between funding

needs and capital availability. However, as growth and demand for funds push real rates beyond 3%, valuation begins to be impaired by the increasing cost of funds. This rationale seems quite natural as the basis for the P/E ratio declining with higher interest rates — whether nominal or real.

For the less frequent events where real interest rates fall significantly below 2%, it becomes more challenging to develop a feasible explanation for the lower P/E's. However, a set of circumstances can certainly be envisioned where low real rates are associated with poor economic conditions and dour prospects for future profit growth. In such a situation, money may be readily available, but the P/E valuation could still be severely depressed by a mixture of dismal growth prospects, elevated risk prospects, and perhaps a reduced market risk tolerance. While such a hypothetical situation is grim, it must be remembered that these conditions are not unknown within the recent history of global markets. Indeed, there are instances where they have persisted for many years.

This "bipolar" behavior at the extremes of high and low real rates could account for the tent pattern in Exhibit 1.

Caveats

At the outset, it should be noted that there are major issues that limit the statistical significance of this (or any) regime-dependent analysis. Even though this tent pattern is quite intriguing, it is a

gross simplification of the complex market dynamics that transpired during this specific time period. Instead of concomitant inflation rates that tend to exaggerate the extremes of the derived real rates, it would clearly have been preferable to be able to use long term expected inflation to obtain estimates of the underlying long term real rates. Moreover, any focus solely on real rates cannot do justice to either the direct effects of inflation itself on equity valuation, or to the more indirect effects from any efforts at inflation control. It could be argued that inflation effects themselves played a significant role in the low P/Es recorded during this historical period. And quite apart from inflation issues, there are alternative scenarios where low real rates could act not as a correlate of low growth, but actually as a facilitator of high growth.

However, the following analysis should not be viewed as purporting to be a comprehensive, literal description of the 1978-2004 experience. Rather, it should be interpreted as a highly suggestive point of departure for characterizing one form of a P/E cycle that could occur in the future — and one that definitely has occurred at certain times and in certain locales.

In addition to concerns about the limited sample of rate regimes and the issues relating to identifying the real interest rate itself, there are other problems that derive from the numerous studies of the short-term response of equity values to nominal interest rate

movements. In virtually all of these “equity duration” studies, most of which have focused on nominal rates, the short-term equity/bond correlations have been shown to be 1) very weak, 2) quite unstable, 3) highly regime dependent, and 4) probably not of much use for predictive purposes [1-6].

More generally, it could be argued that both nominal and real rates should both affect equity valuations, each in different ways and with distinct levels of consistency [7-10]. Indeed, a number of recent papers have made the point that such “double duration” effects are not uncommon in the financial markets [11]. Even beyond the interplay of inflation, nominal rates and real rates, there will always be a myriad of other factors and considerations that affect equity prices in complex ways.

These caveats are intended to make it clear that the following analysis is basically conjectural in nature. The hope is to shed light on certain aspects of a complex problem that has great importance for a number of key issues in institutional investment.

DB Funding Ratios

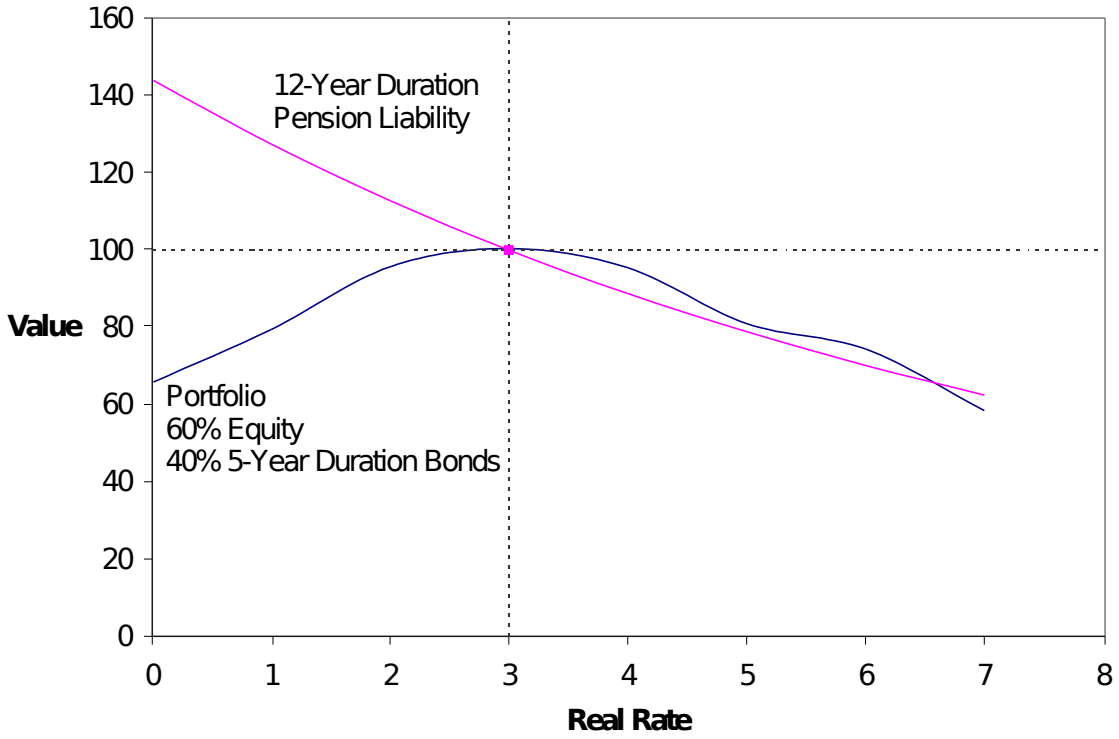
In particular, a P/E tent pattern has intriguing implications for the asset/liability management of defined benefit (DB) pension fund. Consider a dollar pension fund that can be simplistically modeled as having 12-year duration relative to real rates (Exhibit 2). This form of liability is not too dissimilar from a growing retirement system that

has both its active and retirement liabilities provided on an inflation adjusted basis. (As pointed out by Barton Waring of BGI, even pension funds that pay only nominal benefits in retirement may have a real rate component in their liabilities because of the correlation between wage growth and systemic inflation [12].) Now suppose that, with real rates at 3%, this liability was 100% funded with a portfolio consisting of 60% equity and 40% 5-year duration bonds. Suppose also that Exhibit 1's tent depicts a snapshot of the movement of equity prices as real rates change.

On the one hand, as real rates moved to higher levels beyond the 2-3% sweet spot, the 60% equity component of the asset portfolio would decline in accordance with the right hand side of the tent. The 40% bond component would also decline, so that the total portfolio would be under considerable stress.

On the other hand, at rates lower than the 2-3% sweet spot, the equity component would again decline, but there would be some offset from increasing bond values. The net effect would be the somewhat flatter tent depicted in Exhibit 2, with the 12-year duration liability value superimposed.

Exhibit 2
Effect of Real Rates on Portfolio and Liability Values



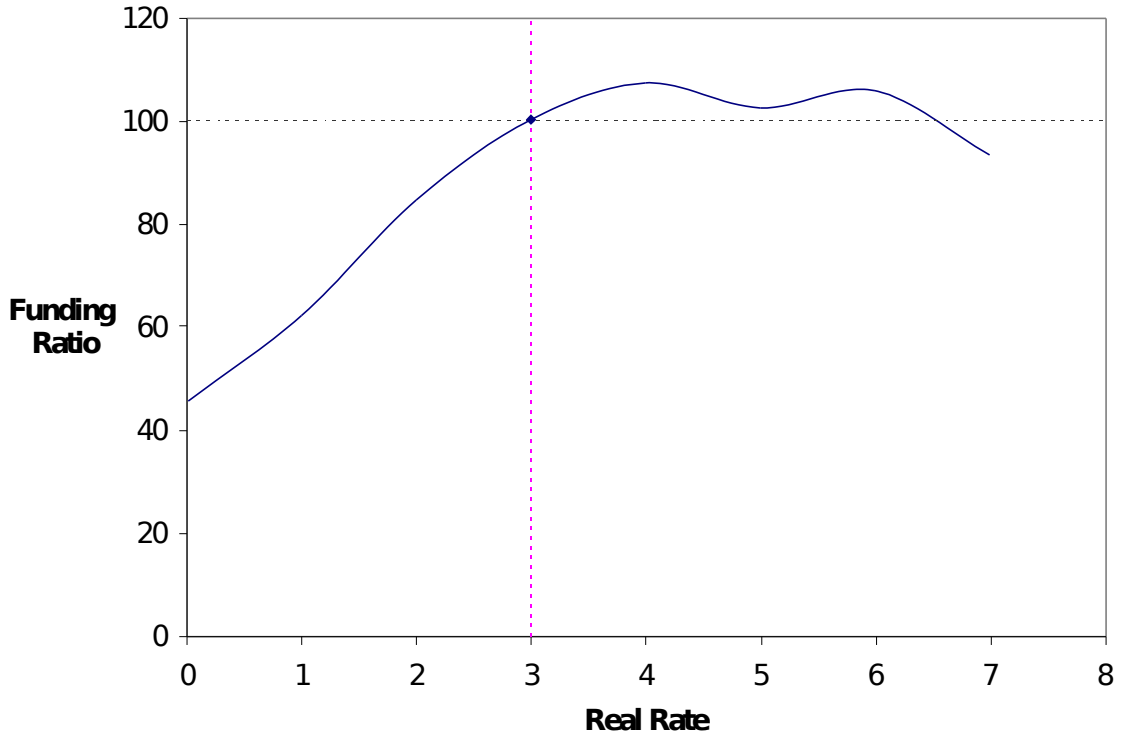
Source: Morgan Stanley Research

Exhibit 3 displays the resulting funding ratio. At the higher rate in the "right hand" scenario, the asset deterioration and the decreasing liability value tend to offset each other so that the funding ratio remains surprisingly stable around the 100% level. In the "left hand" scenario of lower rates, the asset portfolio would also decline as the 60% equities fall more sharply than the 40% in the modest-duration bond component. However, under low real rates, the long-duration liabilities would soar. As shown in Exhibit 3, in contrast to the asset/liability offset seen under rising rates, this left hand scenario of falling rates would lead to a severe deterioration in the funding ratio,

driven by a "perfect storm" of asset deterioration and rising liability values. Thus, the overall pattern for the funding ratio is a surprisingly high degree of stability at higher interest rates, but a horrendous falling off at lower rates.

To keep this paper within reasonable bounds, we have focused solely on real rate effects and have intentionally avoided discussing the role of inflation. However, it is important to at least take note of stagflation scenarios where high nominal rates combine together with low real rates and lackluster growth. In such an environment, the high nominal rates would reduce the liability value for many DB plans and would help offset any asset-driven decline in their funding ratios.

Exhibit 3
Effect of Real Rates on Funding Ratio



Source: Morgan Stanley Research

Even if only partly descriptive of an underlying reality, Exhibit 3's funding ratio pattern would have considerable significance for asset/liability management. The dwell time and stability of the different interest rate regimes would then take on great importance. For example, if the low-rate doldrums scenario represented a potential "trap state" that could persist for years, then the pressure to establish a liability hedge would become increasingly compelling. On the other hand, if a reversion to the sweet spot could generally be assured within a reasonably short span of time, then the asset/liability issue would take on quite a different character.

Equity Valuation Models

As part of a broader effort to understand how equity values interact with various liability scenarios, it is worth trying to gain insight into the kind of equity models that might be consistent with this rather curious tent pattern.

In order to bring as much simplicity to a number of complex issues, the following discussion will focus strictly on how real rates affect pension liabilities and equity valuation. The important roles of expected and realized inflation will be touched on only obliquely.

The standard cash flow models for equity valuation are based upon the early work of John Burr Williams [13], as well as the more

recent work of Myron Gordon [14], Damadoran [15], and many other authors. These models cover a wide range of complexity. In practice, the challenge is to find a model that has sufficient granularity to address the relevant variables in an illuminating way without becoming so involved as to obscure the necessary intuitional judgments.

In the context of the P/E tent, the initial problem is that the standard present value models basically applies a discount rate to some proxy measure for a growing stream of dividends. When this cash flow is discounted at even lower rates, the valuation simply increases without bounds. Thus, Exhibit 1's non-monotonic tent pattern presents a problem for the standard models. To explain such a tent effect, a model is needed that incorporates parameters that interact with changes in real rates. In striving to find valuation models that conform to the P/E tent, the hope is that the proposed functional interactions have a reasonable degree of intuitive appeal.

In a series of papers published in the 1980s and 1990s, the author and his co-author Stan Kogelman developed a valuation approach referred to as the "franchise value" model [16]. The parametric structure of this model makes it amenable to regime-based values that can help explain this tent-like behavior.

In the franchise value model, equity valuation is separated into two basic components. The first component is the value associated

with a firm's current book of business, as articulated in a "perpetual-equivalent" stream of earnings that could be generated without further investment. This first component was referred to as the tangible value. The second component, the franchise value, is derived from the growth of productive investment opportunities available to the enterprise. These opportunities provide added value only to the extent that they are able to generate returns in excess of the cost of capital. A key simplification is obtained when this franchise value is approximated by the product of two basic factors — one characterizing the growth of the opportunities for investment and a second factor representing the net present value generated from their average excess return.

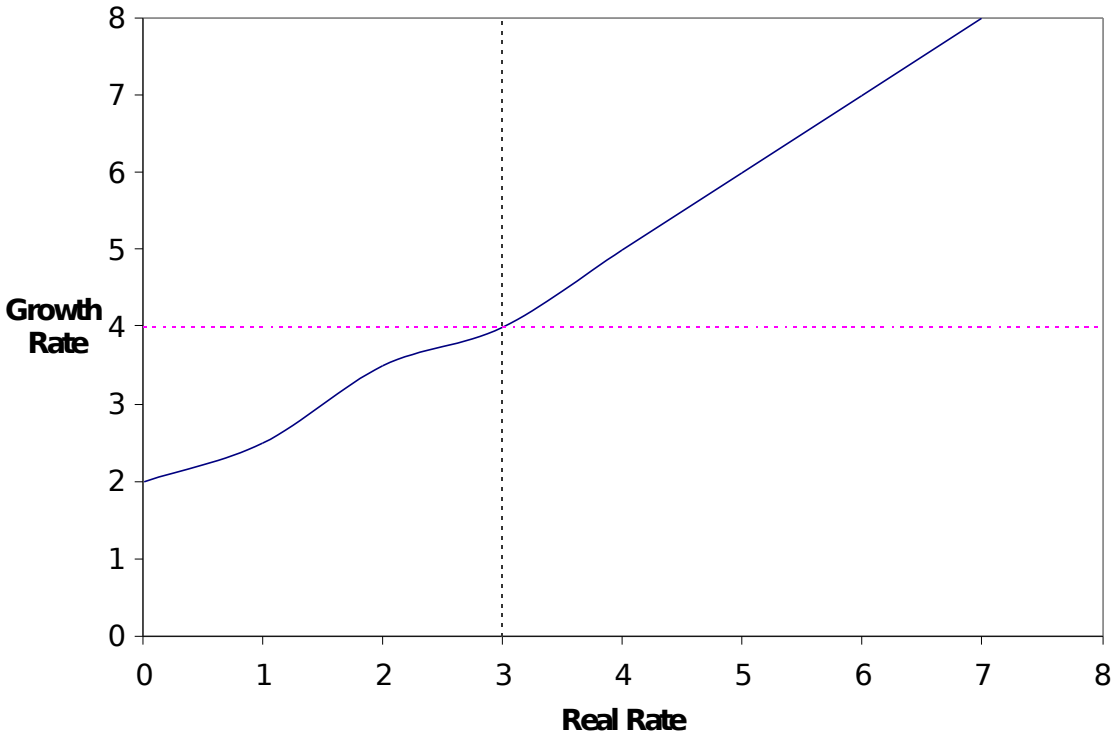
A detailed description of the franchise value model is presented in the Appendix. In the following discussion, we use this franchise value framework to develop a hypothetical set of regime-dependent parameter values that generate a tent-like P/E pattern similar to that shown in Exhibit 1.

Creating a Franchise Value Tent

At the outset, if growth is kept constant in a standard model, the P/E would indeed decline with higher discount rates. However, in the left hand direction, the P/E would keep on rising as the discount rate dropped lower and lower. Moreover, it does not seem realistic to treat growth prospects as being unaffected by shifts in real rates.

If real rates reflect the demand for capital under various growth scenarios, then a more reasonable model would appear to have growth prospects vary with real rate levels. Exhibit 4 presents an example of one such relationship centered on a 4% real growth rate in the sweet spot of 3% real rates. However, even with more realistic growth patterns, such as the one depicted in Exhibit 4, standard valuation models would typically lead to a P/E response that would still be monotonic in one direction or the other: if growth was assumed to respond too weakly to higher rates, P/E's would continually fall, while if growth was assumed to increase too strongly, then P/E's would continually rise. In either case, a cash flow model based on a standard discounting process, would require considerable distortions to come close to replicating Exhibit 1's P/E tent pattern.

Exhibit 4
Growth as a Function of Real Rates



Source: Morgan Stanley Research

As shown in the Appendix, the franchise value approach subjects growth prospects to a more rigorous discounting that dampens the value contribution at higher discount rates. With this valuation process, the P/E's will turn down at some point as higher rates overwhelm the associated higher growth prospects. At lower rates, the corresponding lower growth rates help to generate lower P/E's. The combination of these two effects at the extremes in interest rates is a key ingredient in creating theoretical P/E's having the tent shape.

In the franchise value model, growth is not viewed simply as a stream of distributable cash. Rather, the fundamental sources of future growth are decomposed into several components, with the first component representing a growing steam of opportunities for new investments. However, a firm's incremental value is then derived from the present value of the excess profits generated by each such investment after deducting the cost of capital. With this treatment, the growth prospects become highly sensitive to interest rates and the associated cost of capital. In essence, the growth prospects are subjected to the following three discount rate effects:

1) the profit flows from a given future investment are discounted back to the time of that investment,

2) each future investment opportunity is then itself discounted back to the present

3) the added value is created only by that portion of a profit stream that exceeds the cost of capital required to create it.

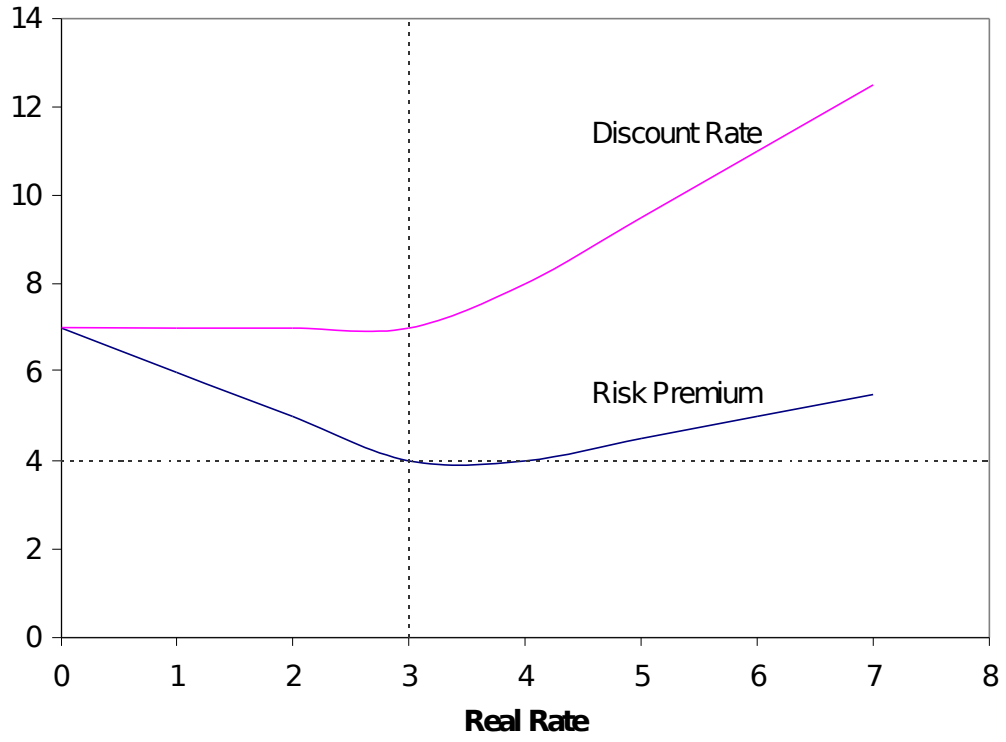
As a result of these discount rate "compressions"," the higher rates in the right hand scenarios eventually come to dominate the associated higher growth prospects.

Two other key variables are the risk premium and a "sustainability factor" that translates current reported earnings into a perpetual equivalent. It is reasonable to assume that both these variables are a function of the real rates and the associated economic

environment. In particular, the risk premium might be expected to display a "smile-like" pattern (Exhibit 5), with the lowest premium in the sweet spot and higher premiums accompanying the rising stress and uncertainties as rates move towards either higher or lower levels. Note that the risk premium here is assumed to be 4% within the 2-3% sweet spot for real rates.

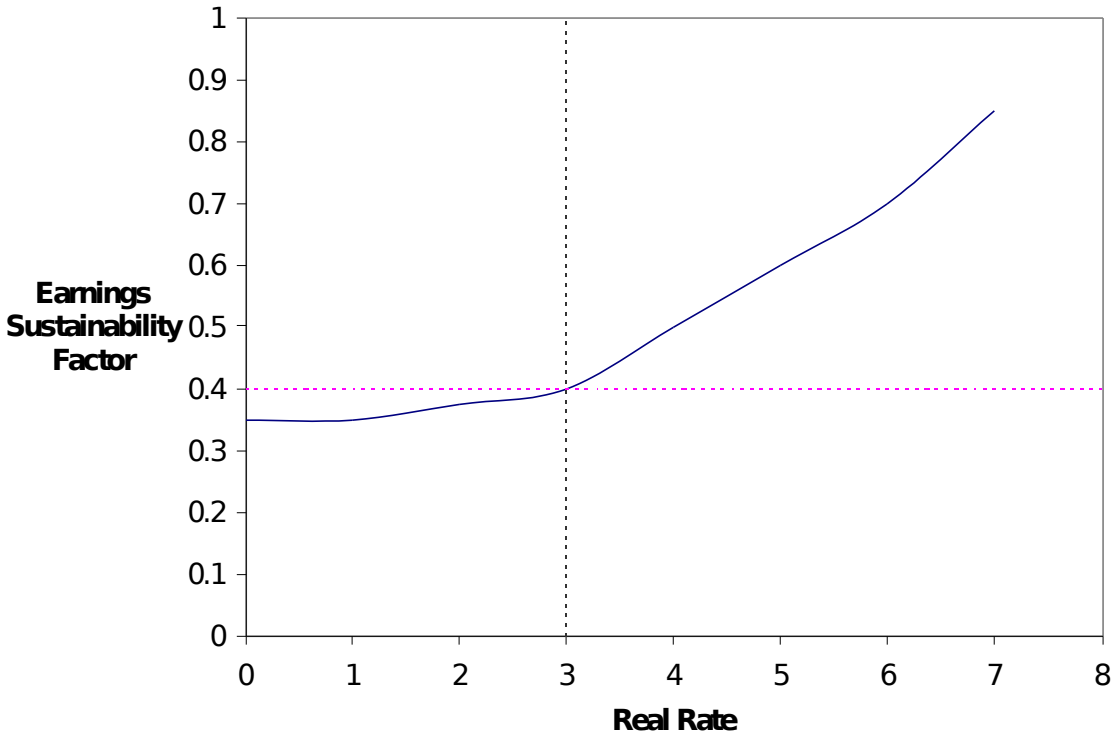
The sum of this risk premium smile and the real rate form the discount rate function that is also shown in Exhibit 5.

Exhibit 5
Risk Premium and Discount Rates



Source: Morgan Stanley Research

Exhibit 6
Earnings Sustainability Factor vs. Real Rates



Source: Morgan Stanley Research

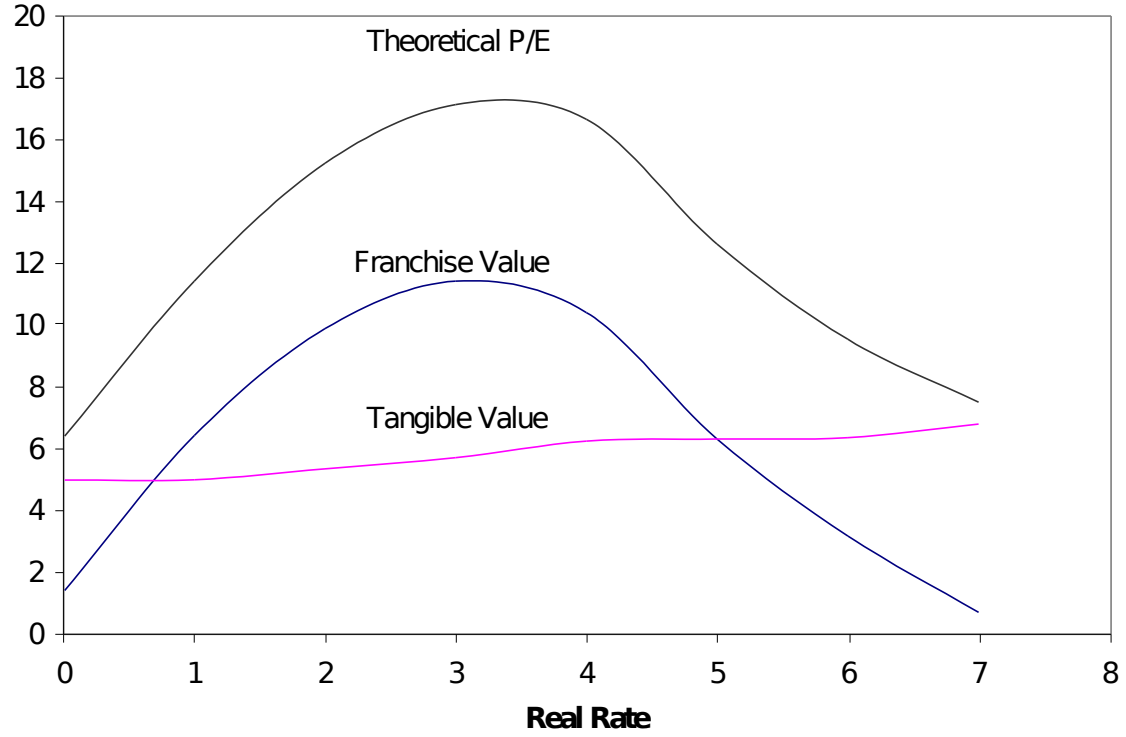
Obviously, there are far more complex valuation models with many additional variables. However, in interest of parsimony, we have elected to focus on this franchise type model with just these three key variables: 1) the growth (of investment opportunities), 2) the risk premium, and 3) the earnings sustainability factor. All three variables are taken to be functions of the real interest rate.

With these key variables having the values depicted in Exhibits 4, 5, and 6, the franchise value takes on the general tent-like form shown in Exhibit 7. Two other parameters, with fixed values, the return on new investments and the return on the current book, play a

role in the model as described in the Appendix. Recall that the franchise value is the present value of the excess profit from future investments. At higher real rates, the discounting together with the compression of the excess profit "spread" dominates the higher growth. At lower real rates, the associated lower growth rates themselves depress the franchise value. In the 2-3% sweet spot, one has a reasonable growth rate subject to a moderate discount rate (7%). The net effect is that the franchise value has the peaked tent-like form shown in Exhibit 7.

In interest of simplicity, the presentation has been developed solely in terms of real interest rates and real growth rates. Obviously, inflation effects also do play a critical and more complicated role in any valuation process. Indeed, most valuations are usually correct using nominal values for discount rates and growth rates. To align our real rate environment with the general intuitions, the relevant rates can be translated into corresponding potential nominal values. For example, under reasonably normal sweet spot conditions, the 4% real growth rate might be viewed as corresponding to a 6-7% nominal rate of profit growth.

Exhibit 7
Theoretical P/E as Sum of FV and TV



Source: Morgan Stanley Research

In addition to the future investment represented by the franchise value, there is the very substantial value contribution from the firm's current book of business. This tangible value term can be modeled in a simple fashion as the singly discounted value of the sustainable current earnings that can be generated without major new investments. Without additional net investments, the current earnings rate will generate a stream of real profits that will generally decay over time. The equity value contributed by this stream can obviously become quite an involved calculation. A common simplification is to transform the current earnings — the denominator

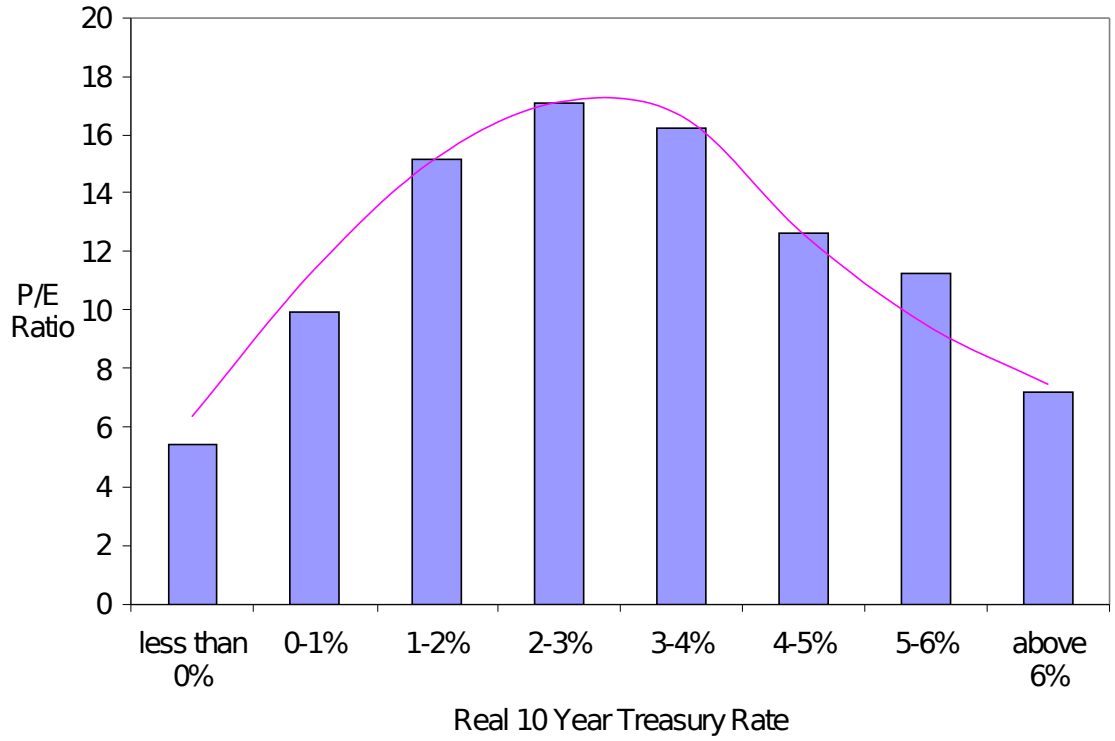
in the P/E ratio — into an equivalent fixed annual rate that can be readily discounted as a perpetual flow.

Under adverse economic conditions, these on-going earnings are likely to be less robust and hence subject to more rapid decay. The effect can be captured in a “sustainability factor” that represents the ratio of the perpetual equivalent to the current rate of earnings. As depicted in Exhibit 6, this sustainability factor can be expected to rise with higher rates and improved market conditions.

Combining the discount rate from Exhibit 5 with the earnings sustainability factor from Exhibit 6, the tangible value term takes on the shape shown in Exhibit 7. The sum of the franchise value and tangible value adds to the theoretical P/E ratio.

Exhibit 8 plots the theoretical P/E as an overlay to the empirical P/E tent, while Exhibit 9 summarizes the representative values that were used in the calculation.

Exhibit 8
Theoretical P/E vs. Actual P/E



Source: Morgan Stanley Research

Exhibit 9
Summary of Representative Values

	Very Low Rates 0-1%	Sweet Spot 2-3%	Very High Rates 6% +
Financial/Economic Environment	Dismal	Balanced	Overheated
Equity Risk Premium	High (6%)	Lowest (4%)	High (5%)
Discount Rate/Cost of Capital	Medium (7%)	Medium (7%)	High (11%)
Real Growth Rate	Very Low (2.5%)	Good/Steady (4%)	Too Much (7%)
New Investment Profitability	Good When Available (6%)	Good (6%)	Squeezed (2%)
Sustainability of Current Earnings	Fair (.4)	Fair (.4)	Good (.7)
Franchise Value Term	Low (4.8)	High (11.4)	Low (3.2)
Tangible Value Term	Fair (5.7)	Fair (5.7)	Fair (6.4)
Theoretical P/E	Low (10.5)	Peak (17.1)	Low (9.6)
Probability of Occurrence	Low	High	Low
Persistence	Hopefully Brief	Sustainable	Almost Surely Brief

Source: Morgan Stanley Research

While the choice of values has been selected to achieve the desired result, our intent is to show that the P/E tent pattern can be generated by a franchise value model with an intuitively reasonable set of values. There is no pretension of empirical validity or theoretical justification regarding the specific functional values. Rather, the values have the limited purposes of sculpting an approximation of Exhibit 1's P/E histogram in an effort to provide some insight as to the nature of the assumptions required to achieve this general pattern.

The Ultimate Risk Scenario

For a pension fund, a key asset/liability question relates to the dynamic nature of the underlying interest rate movements. As shown in Exhibit 3, there is a range of higher rates where the funding ratio remains reasonably stable. However, at some levels, real rates and growth conditions may go beyond a tipping point that would cause a reversal in the growth prospects themselves. In essence, very high real rates would drive the extreme right hand scenario back either 1) toward the sweet spot (a soft landing) or 2) towards the dour left hand scenario (a hard landing). With a landing deep into the lower rate regimes, the question then becomes whether the growth-doldrums will be temporary with a reasonably quick recovery, or whether it will persist as a trap state with low real rates, high liabilities, weak asset

prices and probably considerable exogenous sponsor stress, i.e., the worst possible situation for a pension fund. It would be most unfortunate for a pension fund to have to discharge a significant part of its liabilities at this low point. Indeed, it could be argued that it is just such a condition that represents the ultimate risk for a pension fund, even one that had been well funded at some earlier point.

At the same time, it should be recognized that Exhibit 1's P/E tent represents only an instantaneous snapshot of the equity price movements. This short-term "snapshot" neglects the critically important evolution of returns over time. From a strategic point of view, one basic motivation for investing in equities (or any risky assets) is the higher returns prospects over the long-term. Taken alone, Exhibit 1's snapshot tends to overstate the risks without adequately portraying the higher expected returns over time.

To provide a more balanced perspective, it is worth noting that real rates — and P/E's — tend to spend an overwhelmingly proportion of time in or near the sweet spot. Any significant move outside the sweet spot mobilizes powerful forces to drive the financial markets back to the central region. Exhibit 10 schematically illustrates these reversionary forces that tend to concentrate dwell time within the sweet spot range.

With reasonably well behaved real rates, all else being equal, after 3, 5, or 10 years, a portfolio with a significant equity percentage

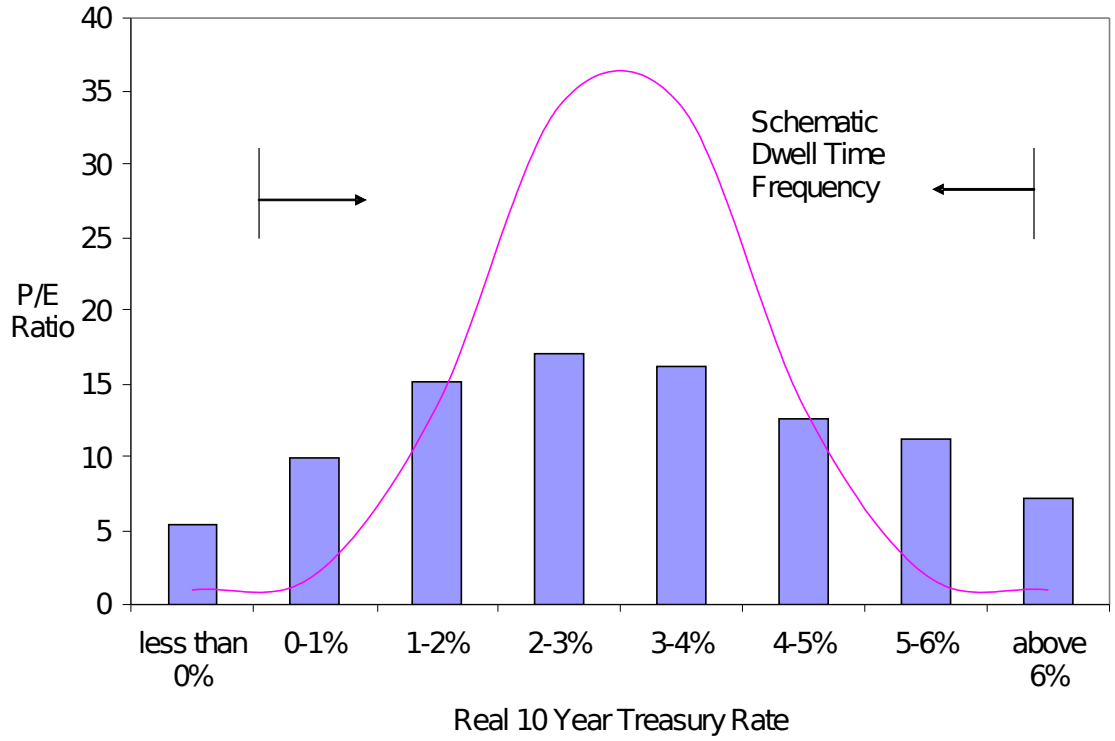
should expect to increase more in value than a standard bond portfolio. Naturally, these greater return prospects from higher risk investments are more appealing to funds that can afford to focus on longer time horizons.

It can be argued that a growing pension fund is the ideal investment format for pursuing such long-term return opportunities.

Risk Control Strategies

A wide range of portfolio actions can soften the funding ratio fall-off from the left-hand scenario. Within the narrow framework of a traditional stock/bond portfolio, a lower equity percentage would limit the left-hand funding ratio decline, but at the cost of reduced long-term expectations over time.

Exhibit 10
Sweet Spot for Real Rates



Source: Morgan Stanley Research

Even within the sweet spot, the short-term volatility of risky assets is always present to some degree. However, the risks associated with P/E tent behavior at extreme rate levels should be ameliorated by their low rate of occurrence and the multiple forces that act to limit their persistence.

Another set of portfolio strategies involves extending the duration of the bond portfolio to offset the liability duration. With a traditional long-only portfolio, an effective liability hedge would require a massive exchange of equities for a much higher (or total) bond allocation. However, in recent years, a number of new

developments allow liability hedging to be pursued while retaining the ability to invest in higher-returning risk assets. There are a number of ways to achieve this portfolio effect — various derivative strategies, liability swaps, or “double-duration” bond portfolios — that allow a significant portion of the cash assets to continue to be invested in pursuit of higher long-term returns.

To this point, the discussion has focused on funds that invest only in equity and some form of fixed income duration. However, the modern trend has been towards broader diversification, with significant allocations in alternative investments such as real estate, hedge funds, private equity, venture capital, etc. Such diversification might be thought to reduce the relevance of this franchise value effect. However, studies have shown that, even among the most highly diversified funds seen in practice, the combination of the implicit and explicit equity exposure continues to be the dominant risk factor, accounting for well over 90% of the total fund volatility [17, 18]. Diversification does serve a purpose of increasing the prospective return from the various new assets but has relatively little effect on the overall volatility of the fund or on its expected level of co-movement with equities. Given this role of equities as a dominant risk factor, one can wonder how much typical forms of diversification would help a private or public pension fund in a persistent low rate/low growth environment. The true benefits of such

diversification would more probably be the higher returns that could be expected across longer-term horizons and possibly the lower volatilities in the less extreme environments.

All the preceding strategies were based upon static allocations. However, the very shape of the tent would argue for consideration of dynamic strategies. These strategies might entail restructuring the allocations in a predetermined fashion depending on the interest level, the general market environment, the current asset valuation, and/or movements in the funding ratio. For example, as interest rates move lower towards the left hand edge of the sweet spot, a fund might consider moving toward a lower equity/longer duration posture. Obviously, the analysis of such strategies can be quite complex and would involve all the caveats — and more — that were named at the beginning of this discussion.

Defined Contribution Plans

The preceding discussion has been focused on the real rate liability of a defined benefit plan that is fully funded at the outset. This asset/liability model highlights a trap state condition that should be of some concern for a wide range of investors in virtually any form of risky assets.

As noted repeatedly, there are myriad factors that affect the long term returns for risky assets. To the extent that some degree of economic growth is sustained and that financial systems are intact,

the efficient market mechanism may be invoked to promise reasonable returns over the long run. However, the real threat to investors may be concentrated in a (hopefully rare) combination of circumstances that we have described as the far “left hand” scenario: economic doldrums, low interest rates, rampant pessimism, widespread erosion of “animal spirits,” limited uptake of available funds, liquidity traps, etc. Under such circumstances, there would be an erosion in the confidence, risk premiums would naturally increase, the growth prospects for productive investment would be minimal, the sustainability of the existing profit flows would become suspect, the correlation among risky investments would tighten — not just as a short term market effect but possibly also in terms of longer term outcomes.

At the same time, the cost of funding long-term liabilities — be they real or nominal or some combination of the two — would soar. In addition, while the liability of defined benefit plans is relatively well articulated (although certainly not well enough for many purposes), there are many “soft” liabilities that hover over vast segments of the economy. In this regard, it can be misleading to find comfort in today’s transition from defined benefit plans to the defined contribution/IRA format.

Defined contribution (DC) plans are really defined benefit plans in microcosm [19]. The DC plan also has a long-term liability. It is

largely a real, rather than a nominal, liability. In contrast to the DB format, an individual's DC plan does not have the benefits of aggregated mortality risk, investment and administrative efficiencies, a broad time span for discharge of liabilities, or the potential for contingent support from a backup sponsor.

DC plans also suffer from a special form of cognitive dissonance. Individuals are prone to take comfort in the buildup of their retirement savings to a level that far exceeds their expectations or their previous experience. However, it is difficult for individuals to realistically assess the problems involved in transforming a given dollar amount of savings into an after-tax after-inflation annual income that can support an increasing longevity span (quite apart from the sporadic demands of various life contingencies). Thus, even at comparable levels of appropriately defined funding ratios, a DC plan maybe more fragile than the corresponding DB analog.

However, for many DC plans, this funding ratio is probably well below that of comparable DB plans. As DC participants move into retirement, they will be forced to more sharply compare their annual needs with the sustainable income from their retirement assets. The stark recognition of the potential shortfalls may well push them toward a less risk-tolerant stance, one that might be furthered triggered by a substantial adverse move in the equity markets.

This litany of problems of would become exacerbated by descent into a left hand scenario. In particular, low interest rates would greatly worsen the dissonance of having to move, within a more limited time, a given pool of savings into a lower-risk, income-producing portfolio structure. Unlike DB plans, an individual may not have the luxury of being able to "ride out" a left hand scenario even one that turns out to last for only a short time period.

Volatility Effects

Another potential market effect that has received relatively little attention is the respective role of DB and DC plans in helping to moderate market volatility [20].

It is well known that DB plans help smooth market movements by their strategy of short term rebalancing. Thus, the DB's rebalancing acts as automatic contrary posture while DC plans tend to provide, at best, a neutral effect. This contrasts with the more momentum-like responses of other market participants that tend to "pile-on" and thereby exacerbate market volatility. However, DB plans are finding themselves increasingly subject to multiple pressures that foster portfolio reallocation into to a lower risk asset/liability posture. To the extent that DB plans move into structures that no longer call for automatic rebalancing, a major source of smoothing activity will be lost. If such a trend becomes widespread, it could eventually create a more volatile environment for risky investments.

In contrast, DC investors tend to forgo any rebalancing — at least in the face of more moderate market movements, and thus they usually have a neutral effect on market volatility. However, DC participants may become less risk-tolerant as they transition into retirement and have to confront the limited adequacy of their retirement savings. In effect, DC plans might become risk-avoiders that "pile-on" to downside moves, which would act to enhance market volatility.

Together, DB and DC plans already form the largest cohort of long-term investment funds in the US market. To some extent, these funds have objectives and concerns that could lead them to move in concert toward lower-risk strategies, all within a limited span of time. As such, they could become a potent factor affecting both the long-term reallocation of risky assets as well as the shorter-term volatility response to fundamental events.

The development in this paper has narrowly focused on real rates and has purposely excluded any consideration of inflation effects. In many scenarios, the movements of nominal and real rates follow similar paths. However, in other instances, inflation can certainly play quite a distinct role in both the determination of liability and asset valuations. Therefore, an important next step would be a more comprehensive treatment of how inflation affects the response patterns of both P/E's and pension funding ratios.

Conclusions

The key point is that the "left hand scenario" evoked by Exhibit 1's tent diagram may represent the ultimate "black hole" for investors subject to some form of long term liability. Such an environment, especially if persistent over time, would exert a gravitational pull on a host of adverse events — low growth prospects, reduced risk tolerance, a move to lower risk assets, increased risk premia, adverse correlations across alternative asset classes, reduced annuity value per investable dollar, deteriorated funding ratios, a pullback of auto-rebalancing strategies together with the associated volatility smoothing, etc. That's the bad news.

The good news is that such events are rare and, for the most part, real interest rates and the associated market conditions tend to be localized within or near the sweet spot. In addition, when events push towards the extreme right or left hand of the tent diagram, natural counterbalancing forces of recovery and/or societal interventions act to speed a return back towards the sweet spot. In particular, the right hand scenario, with its excessively high cost of capital, is inherently self-correcting. As for the more troublesome left hand scenario, the good news here is that such events truly seem to be rare in occurrence — and even more rarely persistent over time.

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Appendix

The franchise value approach segregates a firm's value into a tangible value (TV) derived from the current earnings (E_C), and a franchise value (FV) generated by future investment opportunities.

The TV is fixed by applying a discount rate to the sustainable equivalent (E_S) of current earnings,

$$\begin{aligned} TV &= \frac{E_S}{k} \\ &= \left(\frac{E_S}{E_C}\right)\left(\frac{E_C}{k}\right) \\ &= e\left(\frac{E_C}{k}\right) \end{aligned}$$

where e is the "sustainability factor,"

$$e = \frac{E_S}{E_C}$$

In turn, the discount rate k can be approximated by the sum of the interest rate y and a risk premium r_p,

$k = y + r_p$

Both the factor e, the risk premium and the discount rate are functions of the underlying interest rate y (and the associated economic and market environment).

The franchise value is based on a parameter g that represents the growth of opportunities to initiate investments that provide a (perpetual equivalent) return R. One year hence, this investment opportunity has a magnitude gB where the numeraire B is the current book value. The investment opportunity grows to gB(1+g) in the second year. By the n^{th} year, the opportunity will have a magnitude,

$gB(1+g)^{n-1}$

Each invested dollar will then generate a net discounted value at the time of investment of

$$\left(\frac{R-k}{k}\right)$$

A secondary discounting the n^{th} investment stream back to the present provides a current value of

$$\left(\frac{1}{1+k}\right)^n gB(1+g)^{n-1}\left(\frac{R-k}{k}\right)$$

The franchise value is then formed by summing across the years, assuming k>g,

$$FV=\left(\frac{gB}{1+k}\right)\left(\frac{R-k}{k}\right)\sum_{i=1}^{\infty}\left(\frac{1+g}{1+k}\right)^{i-1}$$
$$=\left(\frac{gB}{1+k}\right)\left(\frac{R-k}{k}\right)\left[\frac{1}{1-\left(\frac{1+g}{1+k}\right)}\right]$$
$$=\left(\frac{gB}{1+k}\right)\left(\frac{R-k}{k}\right)\left[\frac{1+k}{k-g}\right]$$
$$=\left(\frac{R-k}{k}\right)\left[\frac{g}{k-g}\right]B$$

In the above derivation, the parameter g is presumed to take the (highly artificial) form of a constant growth rate over time. In a more general formulation, the expression for the franchise value is expressed in terms of a generic density function g(R,T) for investment opportunities at time T that generate a future return R.

The theoretical firm value P is the sum of these two components P=TV+FV, and the price earnings ratio (P/E) is obtained by dividing by the current earnings,

$$\frac{P}{E}=\frac{TV}{E_C}+\frac{FV}{E_C}$$
$$=\frac{e}{k}+\left(\frac{R-k}{k}\right)\left(\frac{g}{k-g}\right)\left(\frac{B}{E_C}\right)$$
$$=\frac{e}{k}+\left(\frac{R-k}{k}\right)\left(\frac{g}{k-g}\right)\left(\frac{1}{r}\right)$$

where r is the current pro forma return on equity.

$$r=\frac{B}{E_C}$$

Note that since R represents new, freshly-chosen opportunities, while r reflects the existing book of business, we should expect that r and R might have quite different values (although the basic Gordon model requires a constant g and R=r). In the paper, the ROE variables have the values R=12% and r=10%. The other variables — g, k, and e — are all assumed to be a function of the underlying interest rate and are depicted in Exhibits 4,5 and 6.

Extensions of the franchise model have addressed a variety of broader issues such as inflation, leverage, accounting/economic parameters, etc. However, the basic model described above is intended to illustrate how a tent-like pattern might emerge from a relatively simple cash flow model with fundamental values that have some intuitive appeal.