Pension Consulting Alliance/EFI Actuaries

Report to the Steering Committee for the

United Nations
Joint Staff Pension Fund

2007 Asset-Liability Project

Asset-Liability Modeling Project & Investment Policy Recommendations

April 2007

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Chapter I
Preamble

1. In December 2006, the United Nations Joint Staff Pension Fund (UNJSPF) retained the services of PCA/EFI to conduct the UNJSPF's first-ever formal asset-liability study. This study is comprehensive in nature in that it develops future projections of the retirement system's financial condition and performance, integrating both investment assets and liabilities associated with the ongoing payment of the retirement system's benefits. As a result, both actuarial and investment expertise is required to successfully complete the project.

2. This initial asset-liability study is expected to help establish a long-term strategic asset allocation target for the UNJSPF and will serve as the foundation for future asset-liability reviews for the UNJSPF. The United Nations Secretary-General (UNSG) and the UNJSPF and its governing bodies should consider this study as *the beginning* of an evolving and ongoing process to (i) select and enhance the strategic asset allocation for UNJSPF and (ii) assess the impact of key investment and solvency-related decisions upon the financial condition and performance of the UNJSPF. While certain strategic investment decisions may arise from this study, such decisions will likely be enhanced and refined as the UNJSPF's longer-term strategic review process takes shape.

3. UNJSPF staff selected PCA/EFI because of its proprietary and patented approach to addressing the unique risk tolerance issues associated with a defined-benefit pension system. In addition, the PCA/EFI asset-liability modeling process seeks significant input from both investment-oriented and benefit-oriented decision makers, making the process highly interactive. Finally, the PCA/EFI process is not an "off-the-shelf" system, but rather, highly customized to meet the unique and special conditions associated with each specific retirement system. As a result, the PCA/EFI asset-liability model is considered a "best practices" approach to developing long-term investment policy.

4. We at PCA/EFI were excited to take on the UNJSPF project because of the unique characteristics of the UN retirement system. While our team has dealt with several of the largest and most sophisticated public retirement systems in the United States, the UN

offered a special opportunity in that it is a truly global pension system investing assets and providing benefits on a global scale and through a global framework. We truly appreciate the opportunity to work with the UNJSPF as, we believe, the process enabled both the UNJSPF and PCA/EFI to benefit and expand one another's perspective and horizons in this area.

5. Given the global nature of this project, we had to rely on resources from several other parties to make this project a success. In particular, Bridgewater Associates and UBS Global Asset Management provided important assistance in modeling time series data associated with several of the non-traditional asset classes and providing inflation and currency exchange rate data across the numerous markets where the UN retirement system participates. Buck Consultants also provided volumes of actuarial data that allowed PCA/EFI to create the asset-liability model utilized by the UNJSPF. Finally, we express our gratitude and appreciation to the UNJSPF ALM Steering Committee and other staff, who spent many hours meeting with us and describing many of the unique aspects of the UN retirement system to us. Clearly, without their guidance, this project would not have been accomplished.

6. Both PCA, Inc. and EFI Actuaries, Inc. say thank you for being given the opportunity to serve the UNJSPF.

Chapter II
Executive Summary

7. The UNJSPF retained PCA/EFI to conduct the UNJSPF's first-ever asset-liability study. The objective of the study is to establish a strategic long-term asset allocation policy for the UNJSPF investment portfolio and to assess its long-term solvency vis-à-vis a range of stochastic simulation-derived investment results. Decision makers should consider this study as the beginning of an evolving and ongoing process to assess the impact of key investment decisions upon the financial condition and performance of the overall UNJSPF Plan.

8. The determination of an asset allocation policy is extremely important as it will be, by far, the most important element of the investment decision-making process, significantly impacting the long-term risk-adjusted performance of the UNJSPF. Other decisions, such as considering certain tactical exposures, the use of external investment managers, the use of active or passive management, and other decisions, while critical, were not within the scope of this study. The asset allocation policy decision, however, provides an important framework to the UNSG to begin considering the practical implementation aspects associated with converting long-term policy intentions into actual investment strategies and projects. The results of this study will also assist the UNJSPF to develop a comprehensive investment policy that would then be approved by its governing bodies.

9. The assignment began in December 2006 and is expected to be completed by May 2007. The UNJSPF project is unique in many respects, primarily due to its global approach to both investing and providing benefits to its participants, retirees and beneficiaries. These unique features added complexity to the project. In particular, the multi-currency nature of the UN retirement system's benefit stream presented modeling challenges that the typical nationally-domiciled pension system (whether in the United States or elsewhere) does not face. PCA/EFI welcomed and enjoyed the opportunity to address these interesting challenges.

10. This chapter of the report summarizes the project. We first provide descriptive background of the UNJSPF. We then present key findings of the asset-liability study.

Finally, we offer a series of recommendations related to adopting a new asset allocation policy for the UNJSPF investment portfolio. These recommendations were developed with significant input from the Asset-Liability Management Steering Committee, whose members provided valuable guidance and perspective during the project.

Background

11. As of 31 December 2005 (the date of the most recent actuarial valuation), the UNJSPF served approximately 150,000 participants, retirees, and beneficiaries from the UN and other 20 UNJSPF member organizations by providing long-term retirement benefits over their life spans. Because of this long-term commitment, the UNJSPF Plan typically operates under a very long-term planning horizon, typically 30-40 years or longer.

12. Among the Plan's members, nearly 94,000 were active contributors to the Fund (as employees) and 55,000 were beneficiaries (retirees or other beneficiaries). These 150,000 members of the Fund reside in 190 countries.

13. The present value of benefits payable to the 150,000 UNJSPF participants, retirees, and beneficiaries totaled approximately $75.3 billion as of the 2005 actuarial valuation. In contrast, the present value of assets used to pay those benefits amounted to an estimated $78.1 billion, leaving the Fund well-funded with an actuarial surplus of approximately $2.8 billion.

14. The $78.1 billion of assets consists of two components: (i) assets on hand (in the form of the UNJSPF investment portfolio) and (ii) the present value of future employer and employee contributions. For estimation and planning purposes, current UNJSPF assets are measured on an actuarial basis and, as of 31 December 2005, had an actuarial value of $27.9 billion. The present value of future contributions amounted to $50.2 billion. Based on these figures, the UNJSPF Plan exhibits excellent solvency and funding to provide benefits to its members for many decades to come.

15. As one might expect, the actuarial value of assets differs from the current market value of assets, since the investment portfolio can be marked-to-market on nearly a continual basis, reflecting market volatility, while actuarial assets values are measured less frequently and are smoothed over time.

16. As of 31 December 2005, the current market value of the UNJSPF investment portfolio was $31.4 billion, exceeding the actuarial value by $3.5 billion. This excess of market over actuarial value generally reflects gains that have been achieved but not yet accounted for in the actuarial valuation process. While such an excess could and will fluctuate over time, the positive current excess is one indicator of the healthy condition of the UNJSPF.

17. In addition to the traditional forms of benefit payment available in most pension plans, UNJSPF retirees may take advantage of a unique mechanism referred to as the two-track feature of the Pension Adjustment System. This benefit arrangement is designed to protect Fund members from reduction in the purchasing power of their

pensions in their local currency. It introduces a source of benefit, liability, and cost volatility that will be discussed in more detail later.

18. Given the above general description of the UNJSPF, the purpose of the asset-liability study is to determine an appropriate long-term strategic asset allocation policy for the $31.4 billion investment portfolio in light of the sensitivities toward plan financial risk held by the Fund's decision makers. The next section highlights findings of the asset-liability study directly related to a risk tolerance framework developed for the UNJSPF.

Findings

19. The 2007 asset liability study identified a series of findings relating to the projected financial behavior of the UNJSPF. The findings are:

a) Annual benefits, as a percentage of annual payroll (participants salary mass), are expected to increase by over 50% over the next 30 years (assuming current investment policy). This shift reflects a "maturing" pension system, particularly as the "baby boomer" generation begins to retire in greater numbers.

b) In light of increasing benefits over time, the UNJSPF is stable and well-funded and is expected to realize additional actuarial gains due to favorable recent investment performance. As a result, over the next five-to-ten years, and based on a range of simulations for investment performance the expected contribution rate, as a percent of payroll, might decline modestly from its current level.

c) Over the foreseeable future, the funded status of the UNJSPF should remain favorable, with long-term projections of its funding ratio (termination basis, with COLA) approximating the 100% level.

d) In simulations of UNJSPF financial condition, we found that there is a fairly wide range of potential outcomes (assuming current investment policy). As might be expected, a significant portion of this volatility is associated with the UNJSPF's two-track feature of the Pension Adjustment System.

    i.) While, on average, benefits (as a percentage of payroll) are expected to rise by 50%, there is potential that benefits could more than double over the next 30 years. Conversely, there is a small likelihood that benefits will hover just above 30% of payroll. As a result, the distribution of benefit growth appears to be asymmetric, favoring more rapid (rather than slower) benefit growth. This characteristic is driven largely by Plan demographic trends and by the two-track feature.

    ii.) The range of actuarial costs is also quite wide, with a small potential for costs to rise to 30%-35% of payroll over the next 20 years while also exhibiting potential to fall below 15% of payroll over an equivalent amount of time. In contrast to benefit growth, the distribution of actuarial costs appears skewed toward the more favorable lower-cost outcomes.

iii.) The two-track benefit feature adds significant volatility to the projected financial condition of the UNJSPF. This is particularly evident in the range of the size of future benefits. As discussed above, the scale of benefits could potentially more than double from current levels over the next 20-30 years. Excluding the two-track feature causes benefit volatility to virtually disappear, providing a much higher level of confidence that benefits will grow steadily to their projected 38% of payroll (a 50% increase over today's levels).

iv.) The two-track benefit feature also adds volatility to the UNJSPF's actuarial cost structure. Excluding the two-track feature yields potential actuarial costs that rise to no more than 30% of payroll, while under the current structure, actuarial costs could potentially rise to 35% of payroll. The range around these cost estimates, however, is substantial.

e) A critical part of the asset liability study is the construction and validation of a simulation model of the UNJSPF. This model is based on member data as of 31 December 2005; as part of the modeling effort, the model projections are compared with the UNJSPF actuarial valuation of the same date.

In most respects, the asset liability model generated results similar to those in the valuation. However, the present value of future payroll was higher than the figure shown in the valuation report, and at the time this report was completed we were not able to determine a reason for the discrepancy. As a result, the costs generated by the asset liability model are about 1% of payroll lower than those produced by the actuarial valuation as of 31 December 2005.

The simulation model, its results, and the comparison with the actuarial valuation are described in greater detail below.

f) The UNJSPF's current asset allocation policy covers four broad strategic asset classes, with allocation targets set as follows: 61% global equity, 30% global developed markets fixed income, 6% diversified real estate, and 3% short-term fixed income. These broad asset classes contain other key investment segments including, but not necessarily limited to, emerging market equity, non-U.S. real estate, value-added and opportunistic real estate, and public market real estate (in the form of REITs).

g) Following input from the ALM Steering Committee, the asset liability study introduced several new discrete strategic asset classes. These asset classes are: Emerging Markets Equity, Emerging Markets Fixed Income, Real Return Assets, and Private Equity. Constraints were placed on each of these asset classes, reflecting potential challenges associated with funding one or more of these asset classes (see Annex II). Maximum potential allocations to any one of these new asset classes range from approximately $1 billion to $2.5 billion. These dollar allocation levels are significant, given the potential program development and implementation challenges associated with these asset classes.

h) Asset classes are modeled assuming that they are, for the most part, passively managed. Certain asset classes, such as real estate and private equity, for a variety of reasons, are not amenable to passive management. Given these caveats, asset-liability studies avoid consideration of implementation, tactical, and added value considerations to allow decision makers to focus solely on the risk tolerance selection and policy portfolio selection issues.

i) Given the multi-currency structure of UNJSPF benefits and liabilities, the asset-liability study incorporated the ability to potentially hedge out currency risk associated with the U.S. Dollar fluctuating versus other currencies. Across a broad spectrum of potential risk tolerances, currency hedging had virtually no impact on strategic asset allocation. This finding indicates that the strategic hedging of investment returns will likely have no impact on the risk-adjusted financial performance of the UNJSPF. As already mentioned, on the liability side the currency fluctuations associated with the two track feature translates into cost volatility which is captured and measured by the range of modeled simulations. The current and expected well-funded position of the plan ensures solvency in the long-term even considering the currency-related volatility.

j) The ALM Steering Committee and PCA/EFI developed a comprehensive risk tolerance framework for the UNJSPF, which considers eight risk factors that more precisely quantify total plan risks. These risk factors are:

1) Avoid actuarial costs above a specified threshold (set at the current contribution rate of 23.7% of pensionable remuneration);
2) Maintain actuarial costs at an acceptable range;
3) Maintain an adequate and/or improving funding ratio;
4) Avoid a funding ratio below an unacceptable threshold (set at minimum of 85% on a plan termination basis);
5) Optimize investment returns in real terms;
6) Avoid producing a negative real return over a three-year investment cycle;
7) Maintain an adequate ratio of assets to benefits; and
8) Avoid an assets-to-benefits ratio that is below an unacceptable threshold.

k) After significant review and discussion of numerous risk tolerance options, the ALM Steering Committee determined a series of risk tolerance philosophies (which select and weight several of the above risk factors) for further consideration by the UNJSPF senior management and governing bodies:

i.) *Prudent Funding* - Places a high priority on improving the funded status of the plan while also focusing on protecting the long-term plan solvency.

ii.) *Return-Oriented* - Places a high priority on achieving a favorable long-term real return while stressing the importance of avoiding sustained negative real returns

iii.) *Defensive* - Places a high priority on maintaining low plan cost volatility and avoiding deterioration in the long-term solvency of the UNJSPF Plan.

l) Optimal asset allocations were derived depending on the above risk tolerance philosophies. Asset allocation mixes varied significantly, depending on the risk philosophy utilized.

Based on the asset-liability model's optimization process, there is a unique ideal/optimal strategic asset allocation mix that best meets each of these different risk tolerance philosophies. Therefore, a key decision for the UNJSPF is selecting an appropriate risk tolerance philosophy that best represents its views about how to manage plan financial risk over the next several years.

Recommendations

a) For each of the three unique risk tolerance definitions presented above, the asset-liability modeling process identified a unique optimal asset allocation mix (see tables below):

Panel A – Utilizing Current Asset Classes Only

	Optimal Asset Allocation - %										
Risk Tolerance Philosophy	**Global Equity**	**EM Equity**	**Total Public Equity**	**Global Fixed**	**EM Fixed**	**Total Public Fixed**	**Real Estate**	**Priv Equity**	**Real Return**	**Short Term**	**Total**
Prudent Funding	57	7	**64**	26	0	**26**	7	0	0	3	**100**
Return-Oriented	55	6	**61**	29	0	**29**	7	0	0	3	**100**
Defensive	54	3	**57**	32	1	**33**	7	0	0	3	**100**
Current Policy	55	5	**60**	31	0	**31**	6	0	0	3	**100**

Panel B – Incorporating New Discrete Asset Classes

	Optimal Asset Allocation - %										
Risk Tolerance Philosophy	**Global Equity**	**EM Equity**	**Total Public Equity**	**Global Fixed**	**EM Fixed**	**Total Public Fixed**	**Real Estate**	**Priv Equity**	**Real Return**	**Short Term**	**Total**
Prudent Funding	51	7	**58**	26	0	**26**	7	3	3	3	**100**
Return-Oriented	53	7	**60**	26	0	**26**	5	3	3	3	**100**
Defensive	47	3	**50**	32	2	**34**	7	3	3	3	**100**
Current Policy	55	5	**60**	31	0	**31**	6	0	0	3	**100**

Two considerations are critical to further narrow this range of policies. First, the UNJSPF must select an appropriate risk tolerance philosophy. Second, there is the choice of whether to retain the current UNJSPF asset class structure, or instead to add new asset classes.

The analysis in this study indicates that addition of new asset classes provides marginal long-term benefits to the Plan, regardless of the level of risk tolerance. Therefore, PCA/EFI recommends that the UNJSPF consider the policies in Panel B, above, that allow for the inclusion of new classes. While these policies reflect a long-term strategic position, implementation of new asset classes may occur over an extended period of time, reflecting the appropriate deliberate steps on the

part of the UNJSPF to enhance its operational, risk-management, and monitoring systems.

During this study we observed that the current UNJSPF asset allocation policy is virtually identical to the Return-Oriented risk tolerance philosophy in Panel A. Electing this risk philosophy, along with the determination to not pursue incremental asset classes at this time, is analogous to remaining with and affirming the UNJSPF's current asset allocation policy.

b) As discussed under the findings section, strategic hedging of currency risk provided no risk-adjusted benefits to the investment portfolio in its role to adhere to the proposed UNJSPF risk tolerance philosophies. Therefore, PCA/EFI and the Steering Committee recommend that strategic currency hedging not be pursued at this time. This recommendation does not preclude the consideration of specific active investment approaches to currency management. At some point in the future, the Investment Management Service may develop findings and recommendations on incorporating active currency management into the investment portfolio as a means to increase investment returns. As with the incorporation of the new asset classes, the UNJSPF will also probably need to update its investment policy, expand its investment team, and reinforce its investment operations introducing trading and risk-management systems.

c) In the course of the asset liability study, we explored the behavior of the two-track feature using stochastic simulation. The results appear to suggest that the long-term impact on liabilities and cost is about twice the current assumption. In a sense, the two-track feature constitutes an open financial option against the UNJSPF which might be exercised at any time during the retirement period. Therefore, depending on the relative behavior of exchange rates it might be expected that when the option is "in-the-money" (e.g. when it has positive intrinsic value to the retiree) it will be exercised.

   Nonetheless, the uncertainties inherent in the two-track feature do not warrant a firm recommendation that the current allowance for two-track costs (1.9% of pensionable remuneration or 8% of contribution rate) be changed immediately. What can be recommended is continued careful monitoring of two-track participation and costs versus the observed real costs, as it is done at the time of the periodic actuarial valuations.

d) For implementation purposes, the ALM Steering Committee may recommend minor modifications to the recommended policy mix. The ALM Steering Committee will present its final conclusions at the next session of the Pension Board.

e) As discussed elsewhere in this executive summary, this initial asset liability study constitutes the beginning of an ongoing strategic review process that integrates the UNJSPF's investment portfolio with the broader financial aspects of the Plan. To fully leverage the knowledge and information gained from this study, UNJSPF decision makers should develop a process to revisit and update key strategic considerations emanating from this project. This process should be

implemented at two distinct levels. At management's level, the ALM Steering Committee should continue to meet to analyze important solvency and asset allocation issues, to perform *ad hoc* and "what-if" analysis as well as to collect and review ALM assumptions including data relative to financial markets. Considering the *sui generis* governance structure of the UNJSPF, the ALM Steering Committee would provide the required integral view and coherent forum to analyze and submit the relevant recommendations to the consideration of the UN Secretary-General and to the Pension Board. At the level of its governing bodies, the UNJSPF should consider the convenience of periodically reviewing ALM related issues. Therefore, we recommend that the asset-liability study should be updated at least following each actuarial valuation (every two years) with the potential for annual reviews to assess evolving changes in the Plan's financial condition, as well as consider new investment approaches and/or areas of investment.

Chapter III
Introduction to Asset-Liability Modeling and the CASSY® Modeling System

Background

20. In a sense, true asset/liability modeling for pension plans is in its infancy. Until recently, there was no real integration between the liabilities resulting from plan benefits and the investment of the assets accumulated to offset those liabilities. Several historical factors created this situation:

a) The computation of plan liabilities and cost were the province of the plan's actuary. Actuarial practice in the pension area originated with the solvency certifications of insurance companies for group deferred annuities in the first half of the twentieth century. As a result, actuarial practice for pension plans followed two principles:

   First, the investment return was assumed to be a single level return for the entire future of the plan. In an environment in which insurance companies were invested in mortgages and fixed income securities with low and stable interest rates, this was reasonable.

   Second, it was assumed that no new members would join the plan. Therefore, current active members would age, join the ranks of the retired, and pass away, at which point the plan would go out of existence. Liabilities and costs were computed accordingly. Again, in an environment in which the solvency of group annuities is being certified, this is reasonable: It would not be good practice for insurance company solvency to depend on the continuing sale of new policies.

   These twin principles – a single, deterministic rate of return and a closed membership – form the basis of current pension actuarial practice.

It is worthwhile noting that the actuarial valuations of the UNJSPF allow for future new participants since it is assumed that the Fund will continue to exist past the lifespan of the current generation. Accordingly, they conform to the first, but not the second of the two principles above.

b) In most corporations and public jurisdictions, the actuary was hired and supervised by the human resource manager.

c) The investment of plan assets was the responsibility of the plan's investment managers. In addition to tactical security selection, the investment manager was also responsible for strategic asset allocation. The dominant paradigm since the early 1950's has been Modern Portfolio Theory (MPT). Under MPT, the focus was on achieving an asset mix on the Efficient Frontier, a portfolio with an expected return as high or higher than any other portfolio with the same risk, as measured by the standard deviation of the return.

In most cases, asset returns were assumed to be joint-normally distributed over a specified time horizon. The construction of an array of expected returns and standard deviations, and a correlation matrix, constituted the principal underpinning of the asset allocation effort.

Plan liabilities and benefit payments were difficult to integrate with MPT in a satisfactory manner. In most cases, plan benefits were modeled as a negative bond to be included in the portfolio, but variation in benefit streams was not modeled. In addition, open plans with future new hires were modeled using closed plan cash flows.

Probably the most serious shortcoming of MPT is that the theory provides virtually no guidance as to how much (and/or what type of) investment risk the plan should take. Standard phrases, such as "maximum return consistent with risk" were used, but there was no way to translate actual plan metrics and management concerns into concrete investment asset allocation decisions.

d) Typically, the investment managers of the plans were hired by and reported to the financial office of the plan sponsor.

21. Therefore, in the twentieth century, asset allocation in pension plans suffered from incompatible professional methodologies on the actuarial (liability) and investment (asset) sides of the pension balance sheet, exacerbated by separate lines of authority within the enterprises sponsoring the pension plans. Under these circumstances, integrated asset/liability management would have been a miracle had it occurred.

22. The situation began to improve in the 1990's, principally as a result of technological advances:

a) Computing power had become vastly less expensive than when traditional actuarial and asset allocation methods were initially developed.

b) Actuarial projections and simulations of open populations, including future new members, became practical given the reduced cost of the computations.

c) Computer-intensive statistical methods – such as the Bootstrap – became available for producing non-parametric (i.e., not necessarily normally distributed) simulated asset class returns.

d) The assumptions necessary for analytic solutions for an optimal asset mix – such as joint normality – could be relaxed, and computer-intensive numerical and simulation methods could be substituted.

e) Object-oriented computer languages were developed that enabled the creation, management, and testing of the complex software needed to integrate asset and liability projections.

Development of V&A

23. Recognizing that the technology was available to produce an integrated view of pension plan investment and funding, EFI Actuaries began development of its Visualization and Animation (V&A) System in 1990. From the outset, V&A was designed to overcome the limitations of current practice. In particular:

a) V&A is an integrated system: Both assets and liabilities are projected and simulated simultaneously on a consistent basis.

b) V&A was designed to allow the study of either open or closed plans. In addition, the design of V&A allowed for the projection of benefits from plans with multiple tiers of benefit provisions, a common trait among government pension plans.

c) V&A was developed from the ground up as a simulation system, in which future inflation, wage growth, and investment returns would be determined by random economic scenarios, rather than by a single actuarial assumption.

d) V&A was designed for government plans. This allowed EFI to ignore the complicated and rigid pension funding rules mandated by the US government for corporate plans under the Employee Retirement Income Security Act of 1974. This resulted in a much faster system than would otherwise have been the case, and allowed for much more complicated simulations.

e) V&A was developed in C++, a computer language combining the elegance of object-orientation with the speed required of a production language. This resulted in the fastest actuarial simulation program possible.

24. EFI prepared actuarial valuations for several years using V&A. Achievement of numerous development milestones at EFI's largest client, the California Public Employees' Retirement System (CalPERS), suggested the direction for further improvements.

Development of CASSY®

25. Beginning in 1996, CalPERS began a series of Asset/Liability Workshops. As a participant in these Workshops, EFI came to realize that V&A offered a highly attractive methodology for integrating and studying the interrelationships of investment strategy and liabilities in a pension plan. As a result, EFI extended V&A to its CASSY® System, applying for and receiving a patent on CASSY® (the first of three patents) in 1998.

26. The CASSY® system relies on a two-way process: first, determining and measuring how a specific asset allocation potentially impacts a pension plan's future financial condition, and second, given a *desired* outcome for a pension plan's financial condition, determining an optimum allocation. The process works as follows:

a) Given a simulation model of a pension system, and given any asset allocation, CASSY® can simulate the future of a pension plan for any length of time. From that simulation, financial attributes of the plan – assets, liabilities, funding ratios, cost, investment return, or other factors – can be measured.

b) The important point is that this process can be turned around: Given a desired financial condition in terms of cost, funding ratio, and so on, we can ask CASSY® to test hundreds or thousands of possible asset allocation mixes to find the one that performs best, using our patented proprietary ranking system.

27. CASSY® provides a solution to the shortcomings of the asset/liability management dilemma of the late twentieth century by:

a) Integrating consistent asset and liability models in a single system.

b) Projecting plan liability on an open group basis; new entrants and benefit tiers are fully modeled.

c) Stochastically modeling projected investment returns and plan costs, using hundreds or thousands of simulation trials, rather than using a single assumed rate of return.

d) Using virtually any technique to model asset returns, from joint normal distributed returns to non-parametric returns derived from statistical resampling.

e) Allowing the plan sponsor to directly determine (i) how plan financial performance should be measured and (ii) what level of performance is desired for each measure. CASSY® then translates these views on plan performance into a quantitative risk tolerance measure that is used to select an optimal asset allocation policy for the investment portfolio. Therefore, the most serious shortcoming of MPT, determining how much risk to take, is solved in an elegant and intuitive manner.

28. CASSY® has been used in all CalPERS Asset/Liability Workshops since 1996.

The CASSY® Process

29. At this point, we will elaborate a bit more on the general process of using CASSY®. The process for the UNJSPF will be described in specific detail later. The standard steps in the CASSY® process are:

a) Collect data from the plan actuary.

The data gathered includes active and inactive member data, financial statements, plan provisions, and the most recent actuarial valuations and experience studies.

b) Organize and format the actuarial data to conform to CASSY®, the simulation and modeling software developed by EFI.

c) Model the liability structure of the plan.

The CASSY® model is customized for each plan. The overall goal is to include in the model all features relevant to the projection of assets, liabilities, and costs. This will include multiple member populations, tiered benefit structures, cost of living adjustments, projected growth rates, and other factors. For some clients, we have modeled the tax structure on which plan contributions depend.

d) Compare the results of the CASSY® model with the results of the plan's last actuarial valuation.

Once the model has been created, EFI compares liabilities and costs derived from its model with those computed in the most recent actuarial valuations produced by the plan actuary.

In most cases, the CASSY® model is in excellent agreement with the actuarial valuations. Rarely, a difference arises that requires reconciliation. This step provides a critical calibration checkpoint for the CASSY® Model, as well as serving as an independent verification of the liabilities and costs in the plan valuations.

e) Present the CASSY® model to staff for review and discussion in one or more meetings.

The purpose of these meetings is primarily educational. The liabilities and costs of the plan are projected and simulated. In most cases, those responsible for the plan have little idea of the levels and volatility of assets, liabilities, funding ratios, and costs that are likely to emerge over time. Accordingly, they are not in a position to set realistic goals for those plan measures that CASSY® can use to optimize the asset allocation.

f) PCA and EFI work with plan management to develop a set of "Decision Factors" for use in optimizing the asset allocation.

These Decision Factors are the measures of plan financial performance that will be used to judge the success or failure of each potential asset allocation policy. Examples could include:

i.) Attaining 100% funding within 15 years;
ii.) Avoiding funding ratios below 80% over the next 15 years;
iii.) Keeping the average plan cost as low as possible for the next 20 years; or
iv.) Avoiding plan costs over 30% of pay at any time during the next 20 years.

Many other Decision Factors can be constructed. The set of Decision Factors is designed to reflect the unique goals, priorities, and sensitivities of the governing body of the plan.

g) Following the selection of the Decision Factors, PCA/EFI simulates hundreds or thousands of different potential policy allocations using randomly generated investment return scenarios.

As noted above, the entire plan – including liabilities, costs, and assets – is simulated using hundreds or thousands of random economic scenarios. The asset and liability sides of the plan are simulated consistently, so that, for example, inflation is appropriately reflected in payroll levels, liabilities, costs, and asset returns.

As each portfolio is tested through the numerous investment scenarios, it is scored across the Decision Factors. The scores derived for each variable can then be weighted based on the preferences of the plan management. The aggregate weighted score for each portfolio then determines whether a specific portfolio is optimal. As might be expected, the optimal portfolio can change depending on how plan management collectively determines to weight each liability-oriented variable in the scoring process.

h) In the final meetings of the process, PCA/EFI works with plan management to develop a consensus weighting that includes the views and preferences of each individual member of the management team.

The result of this process is a draft asset allocation policy.

i) Before formally adopting the proposed policy, plan management will review implementation issues associated with moving to the new policy.

30. In summary, taken together, the CASSY® process is:

a) Integrated – assets and liabilities are modeled together in a consistent structure;

b) Customized – the process is tailored to the plan and its management;

c) Interactive – plan management has ample opportunity to express and review the impact of their unique goals and concerns regarding the plan;

d) Educational – no other system provides as much information to plan management about the dynamics and risks associated with the plan they are responsible for; and

e) Robust – because of its simulation capabilities, CASSY® is not dependent on the many assumptions underpinning traditional investment finance theory.

31. It is for these reasons that CASSY® has become a "best practice" for asset allocation in the pension community.

Chapter IV
The UNJSPF Asset-Liability Model

Background

32. PCA/EFI submitted a proposal dated 21 April 2006 in response to the United Nations Request for Proposal RFPS-922 for an asset/liability management study (ALM Study, the Study). PCA/EFI personnel participated in an interview at the United Nations on 9 June 2006. On 23 October 2006 PCA/EFI was informed of the intent of the United Nations to award the contract to PCA/EFI. The contract was executed 19 December 2006.

Goals

33. The goal of the ALM Study is to assess the impact of key investment and solvency-related decisions upon the long-term financial condition and performance of the overall UNJSPF and to determine a strategic asset allocation that meets the performance goals of Fund while taking into account its risk tolerance. To this end, a comprehensive simulation model of the Fund is constructed; this simulation model uses the EFI CASSY® platform discussed in the prior chapter. Its purpose is to measure the financial performance of the Fund with different asset allocations, thus allowing the Fund to select an optimal policy mix.

34. The simulation model is built using the data, methods, and assumptions included in the most recent actuarial valuation of the Fund, which was performed as of 31 December 2005 by the Fund's Consulting Actuary (Buck Consultants).

Data Gathering

35. Early into the project, PCA/EFI began gathering the information needed for the ALM Study. Copies of the actuarial valuation and the most recent experience study were received from Fund staff, as well as the Regulations and Rules of the Fund, and information about the Fund's unique two-track feature of the Pension Adjustment System. Member data from the 31 December 2005 actuarial valuation was received on 18 December 2006 from Buck Consultants.

Modeling

36. Once EFI gathered the data, modeling of the UN pension system began. The CASSY® Model of the UN pension system (the Model) has now been through five iterations, being modified and refined at each step. The initial model – internally designated as Version 9.70 – included all active members, but valued the retirement benefit only. This Model was presented and reviewed with the ALM Steering Committee at a meeting in New York City on 12 January 2007.

37. Subsequent models followed. Version 9.71 included all benefits, and Version 9.72 added a special asset model to reflect the current and anticipated asset classes for Fund investments. The latter model was reviewed at an ALM Steering Committee meeting on 9 February 2007.

38. In Version 9.73 the two-track feature was fully implemented and additional internal refinements were introduced. This model was presented to the ALM Steering Committee at a meeting on 26 February 2007.

39. As a result of the discussion and feedback at the 26 February meeting, the final version, Version 9.74 was constructed. In Version 9.74 some refinements were made in the modeling of the two-track feature, and a new Decision Factor was introduced. This version has been used for the results presented in this Report.

Comparison with 2005 Actuarial Valuation

40. As EFI constructs the CASSY® model, EFI compares the Model's output with the results from the 31 December 2005 UNJSPF actuarial valuation. The preliminary results were mixed.

Figure 1 – EFI Liability Model vs. 2005 Actuarial Valuation Comparisons

	2005 Actuarial Valuation	***Model Results***	***Ratio***
Present Value of Benefits	75,312,650,007	72,482,089,337	96.24%
Present Value of Payroll	214,690,000,000	229,761,524,830	107.02%
Projected 2006 Payroll	6,677,000,000	6,758,420,432	101.22%
Actuarial Cost	22.414%	21.27%*	94.90%

*Adjusted upwards to account for approximate 4% of payroll differences discussed below.

41. In the table above we note that the Model produces a present value of benefits about 3.8% below that appearing in the 31 December 2005 actuarial valuation. This is within a reasonable tolerance for this type of study. In an audit, we generally expect to be within 5% of the liabilities for the plan being audited.

42. Furthermore, in constructing the Model we streamlined the benefit modeling to the extent possible to improve computational efficiency and reduce simulation runtimes. Consequently, certain minor benefits, such as children's benefits, are not included in the Model. Therefore, we would expect that the results of the Model would vary slightly with those of the actuarial valuation. For example, the liabilities produced by the Model were expected to be slightly below those produced by the 2005 valuation. In the final

Model, the liabilities for minor benefits are approximated by a load of about 4% on the major benefit liabilities.

43. We can also observe several differences in the treatment of payroll assumptions in the Model versus those utilized by Buck Consultants, which may lead to minor differences. Nevertheless, we have been unable to fully explain the discrepancy in present value of future payroll between the 31 December 2005 actuarial valuation and the valuation produced by Version 9.74 of the Model (the final version). We note in the table above that the Model's present value of payroll is 7% higher than the actuarial valuation's present value of payroll, but the Model's projected 2006 payroll is only 1% higher than the actuarial valuation's projected 2006 payroll. We investigated this with the current UNJSPF Consulting Actuary (Buck Consultants) and discovered the following:

a) In computing the present value of future payroll, the UNJSPF actuary delays the addition of new members until the beginning of the next plan year. Therefore, for example, active members terminating during 2006 are replaced only at the beginning of 2007.

   In the Model, we assume that new hires occur throughout the year, so that members terminating during 2006 are replaced, on average, in the middle of 2006. This causes the new hire pay to occur sooner, and increases the present value of future pay by between 3% and 5%.

b) The UNJSPF Consulting Actuary supplied PCA/EFI with a series of payroll figures that were discounted to produce the present value of payroll shown in the 31 December 2005 actuarial valuation. However, the rates of increase in the payroll figures do not agree with those computed by the Model. In particular, in the relatively distant future, in 40 or more years, the payrolls produced by the Fund actuary are increasing at between 4.3% and 4.4% per year, while those from the Model are increasing at about 4.5% annually. The actuarial assumption is that payroll growth is 4.5% per year, and in the distant future, the projected pay should be increasing at about this rate, as it does in the Model.

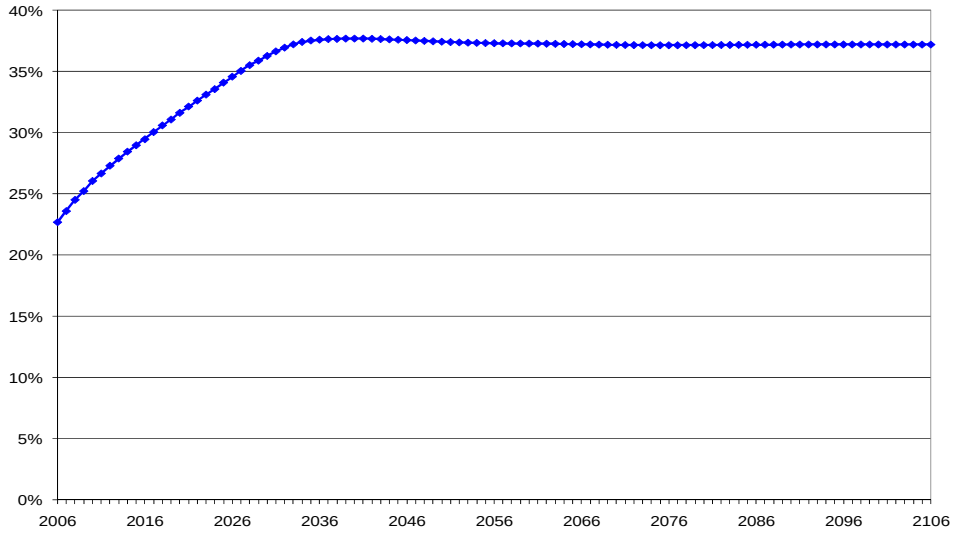
   In addition, in Table E-1 of the 31 December 2005 valuation report, a column of contributions is presented for 50 years. These contributions, computed as 23.38% of payroll, show annual growth rates that are very close to those projected by the Model, but they differ from those in the payroll figures provided by the Fund Consulting Actuary.

44. Therefore, we are unable to fully confirm the present value of payroll figure provided by the Fund Consulting Actuary. Our model and methodology have been tested and verified over dozens of ALM studies and thousands of actuarial valuations over the past 16 years. Considering that the objective of the study is not to perform an actuarial audit but rather to model the long-term behavior of the Fund's benefit structure and the interrelationship of assets and liabilities using a stochastic simulation approach, we did not further explore the potential causes for the minor differences observed or further refined the Model with Plan benefit considerations. Accordingly, we used the ALM Model figure in preparing this Report.

Findings – Deterministic

45. The first use of an ALM Model is to project the benefits, cost, and funding ratio of a plan on a deterministic basis – assuming that all actuarial assumptions are exactly met. In particular, these projections presume that future investment returns, salary growth, and inflation are exactly in line with the Fund's actuarial assumptions.

Figure 2 - Projected Benefits as a Percentage of Active Payroll

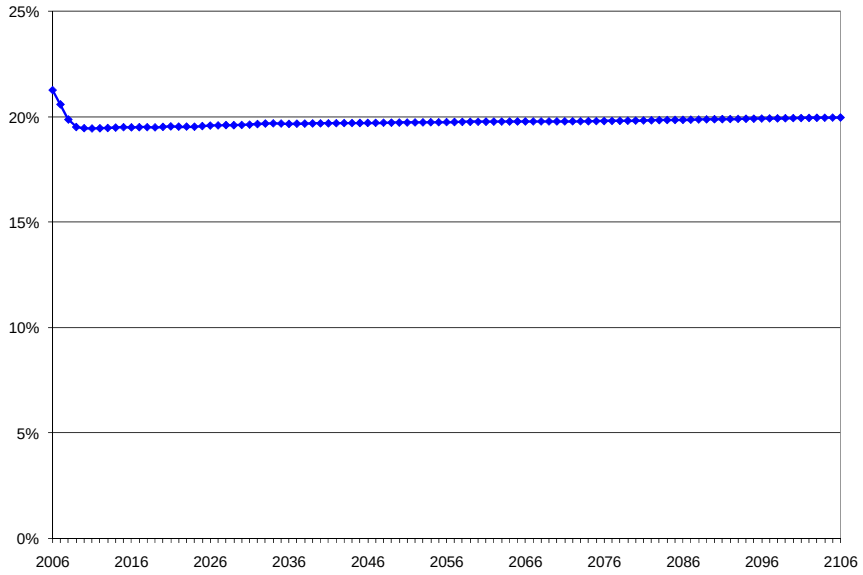


The horizontal axis is time in years; 100 years are shown. The vertical axis is UNJSPF benefit payments as a percentage of UNJSPF active payroll.

46. Figure 2 above shows a projection of UNJSPF benefits for the next 100 years as a percentage of active member payroll. We note that benefits will increase relative to payroll over the next 30 years, rising from a current level of about 23% of pay to a maximum of about 38%. All actuarial assumptions are assumed to be realized. The active workforce is assumed to grow by 0.5% per year for the first 10 years of the projection, and to remain level thereafter.

47. We note in Figure 2 that the Fund is not yet completely mature: Benefits have not reached their ultimate level as a percentage of pay.

Figure 3 - Projected Actuarial Cost as a Percentage of Covered Active Payroll



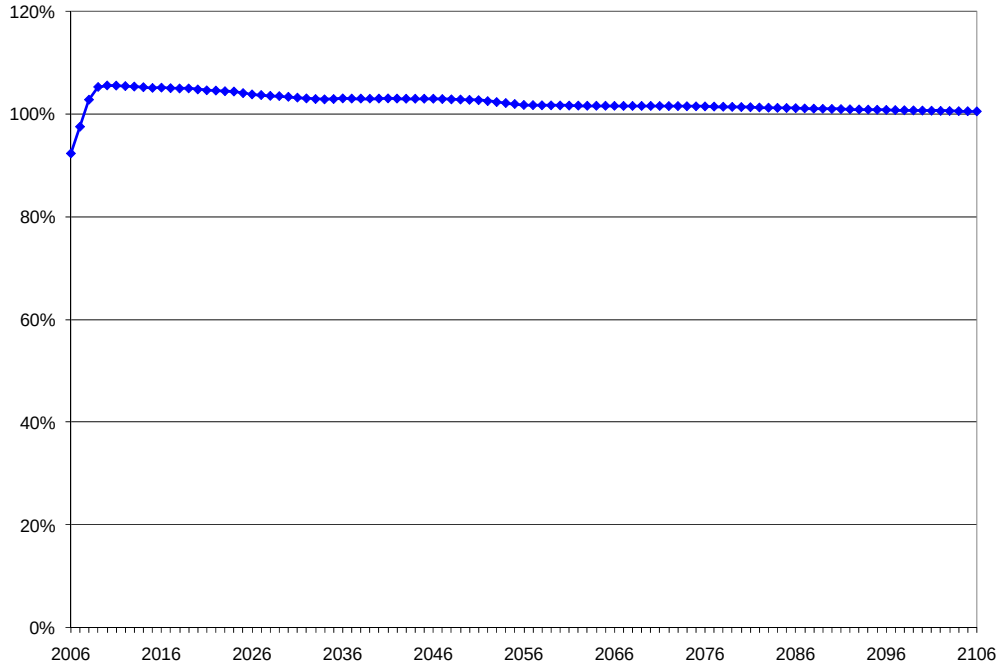
The horizontal axis is time in years; 100 years are shown. The vertical axis is total actuarial cost as a percentage of active payroll. Cost assumes the actuarial cost is the amount contributed each year.

48. Figure 3 (above) shows the projected actuarial cost of the Fund for the next 100 years as a percentage of active payroll. Again, all assumptions are met in this projection. Of note is that we assume a nominal return of 7.5% per annum on the market value of Fund assets, and we assume that the amount contributed to the Fund in the long term is equal to the theoretical actuarial cost.

49. In the first five years of the above projection, investment gains not yet included in the actuarial value of Fund assets are realized, causing actuarial gains and a decrease in the projected actuarial cost of the Fund. After this initial period, the projected actuarial cost remains about level at around 20% of pay.

50. Note that the initial cost in Figure 3 is 21.27% of pay, which should be compared with the cost from the 31 December 2005 actuarial valuation of 22.41%. The difference arises from the difference in the present value of future payroll discussed earlier.

Figure 4 - Projected Funding Ratio



The horizontal axis is time in years; 100 years are shown. The vertical axis is the actuarial value of Fund assets divided by the total UNJSPF accrued liability.

51. Figure 4 above shows the projected funding ratio. The actuarial value of Fund assets is compared with an accrued liability based on pay and service to the valuation date; cost of living increases are included in the liability calculation. This is the same funding ratio computed in the actuarial valuation.

52. We note in Figure 4 that the funding ratio increases sharply for the first five years, as investment gains are recognized in the actuarial value of assets. From that point forward, the projected funding ratio gradually tapers down to about 100%.

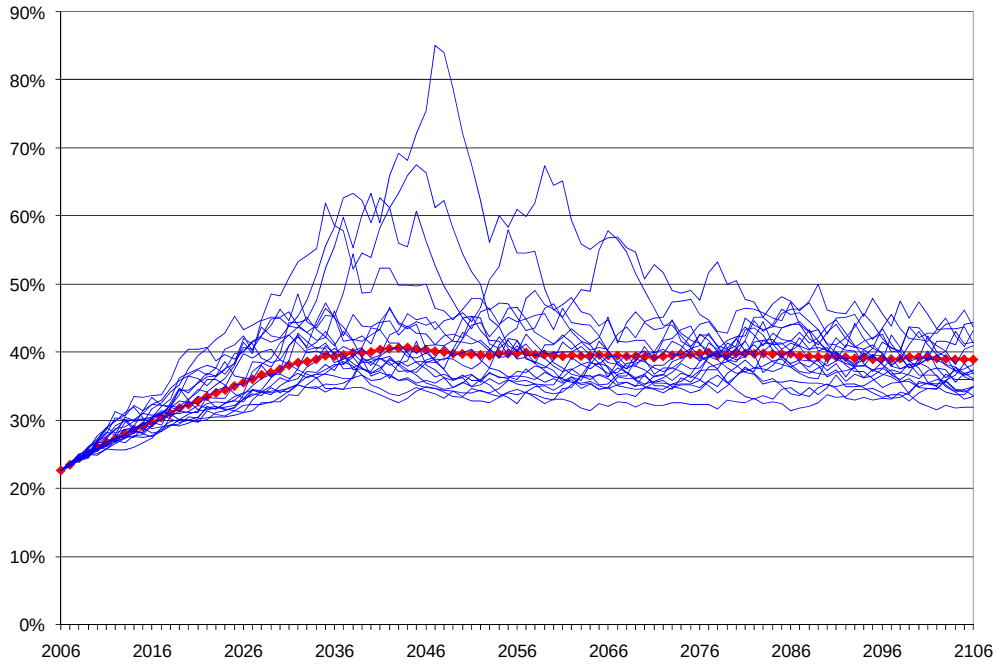
Findings – Stochastic

53. A primary function of the Model is to *simulate* the behavior of a pension plan using hundreds or thousands of random economic scenarios. In this way we can project the financial condition of a pension plan across various proposed asset allocations. Then we can use the Decision Factors and the risk philosophies, discussed below, to help determine an optimal asset allocation policy. In addition, we can determine how much variability is present in the liabilities and costs of our plan.

54. Figure 5 on the following page shows the result of a simulation of the benefits to be paid from the Fund for the next 100 years. In the simulation we allow the inflation rate, salary growth rate, investment rate of returns, and the two track feature benefits to vary over time. Therefore, while the average of the stochastically-simulated projected benefit is not dissimilar to deterministic projected benefit shown in Graph 1, there is a substantial

range of potential outcomes associated with the simulated benefit. Most of the variation arises from the two track feature, which will be discussed in more detail below.

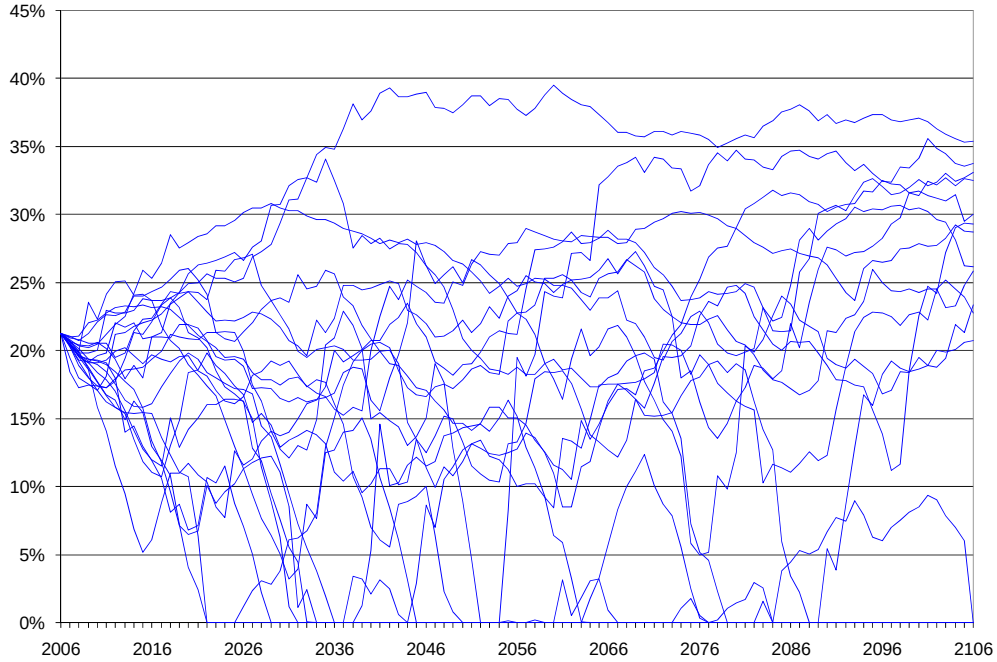
Figure 5 - Simulated Benefits as a Percentage of Covered Active Payroll



The horizontal axis is time in years; 100 years are shown. The vertical axis is benefit payments as a percentage of active payroll. 100 simulation trials were performed; 20 of them are shown in blue. The red line is the average cost of the 100 trials.

55. Figure 6 on the next page shows the result of a simulation of the actuarial cost of the UNJSPF. This graph is the same as Figure 3 with an important exception: Rather than assuming that inflation and investment returns match the actuarial assumptions year after year, we assume that investment returns and inflation will vary annually, as they actually do. The actuarial cost was measured in 100 simulation trials, each of which used a randomly generated, but realistic, economic scenario. The asset allocation is the current policy.

Figure 6 - Simulated Actuarial Cost as a Percentage of Active Payroll – Current Asset Allocation



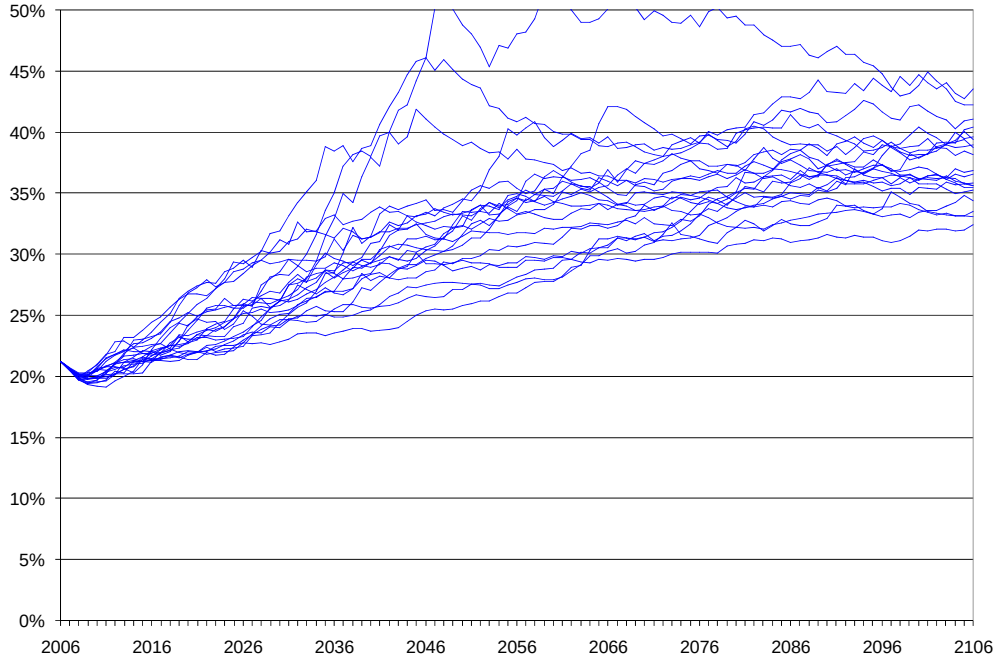
The horizontal axis is time in years; 100 years are shown. The vertical axis is total actuarial cost as a percentage of active payroll. 100 simulation trials were performed; 20 of them are shown in blue.

56. What is remarkable about Figure 6 is the variation in cost: Costs of nearly 40% of pay are possible, if unlikely, and at the other end of the range there are some trials that produce no cost at all after about 15 years.

57. In Figure 7, on the next page, we show the simulated actuarial costs if 100% of Fund assets were invested in short term fixed income securities. We note that while the variation in Fund cost is much lower than in Figure 6 (the current asset allocation), the cost to the Fund is much higher – increasing to an average of around 40% ultimately, over twice as high as with the current allocation.

58. Figures 6 and 7 illustrate the classic tradeoff between risk and reward (using the level and volatility of actuarial cost as the key risk variable): Avoiding risk (i.e., significant actuarial cost volatility) by investing in short term securities reduces the investment return far below the actuarial assumption, creating actuarial losses, which increases the level of actuarial cost borne by the Fund. On the other hand, seeking higher returns through investment in riskier securities lowers the average actuarial cost of Fund benefits, but at the expense of year-to-year variation in that cost, which can introduce uncertainty into the budgeting process.

Figure 7 - Simulated Actuarial Cost as a Percentage of Covered Active Payroll – 100% Short Term Allocation



The horizontal axis is time in years; 100 years are shown. The vertical axis is total actuarial cost as a percentage of active payroll. 100 simulation trials were performed; 20 of them are shown in blue.

Findings – Two Track

59. The two track feature provides protection to USJSPF benefit recipients from the uncertainties associated with receiving a U.S. dollar pension and facing living expenses in a different local currency. For each member electing a two track benefit payout, two benefits are computed, one in U.S. dollars with U.S. inflation, and one in another country's currency (local currency) with local inflation. Comparisons are made quarterly on the local currency amounts. After applying certain limitations (110/120 percent caps), the member receives the greater of the two amounts. The member can elect to join the two track when benefits begin, or later. However, the exchange rate at which the local currency track amount is established is fixed on the date of separation from service. Leaving the two track requires a change in the member's country of domicile.

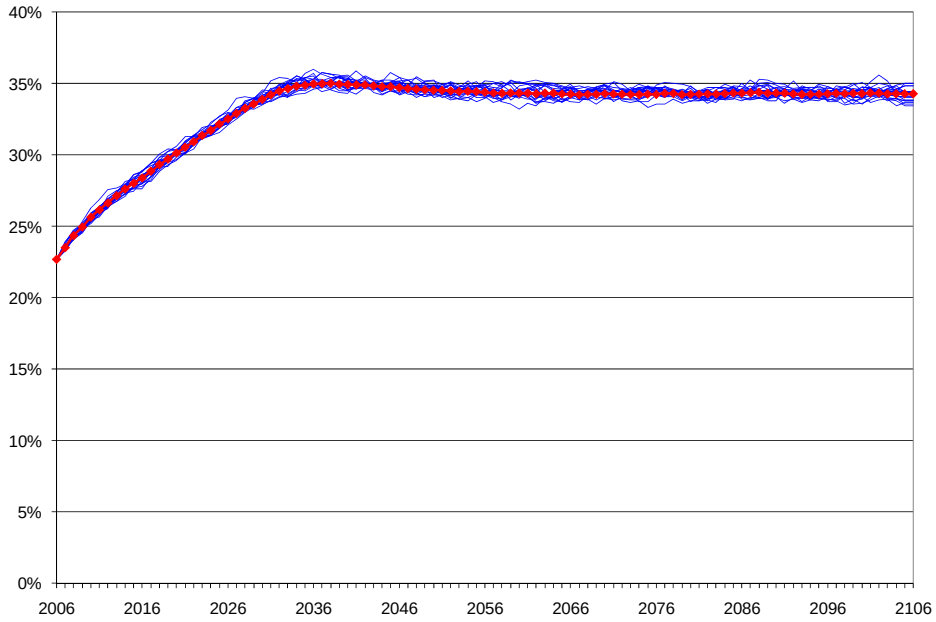
60. While we have provided only a brief summary of the two track feature, the key point is that for many UNJSPF beneficiaries, the benefit paid depends on currency exchange rates, both at retirement and thereafter, and on U.S. and local inflation rates.

61. The two track represents an option, and as such there is clearly a cost to the Fund in providing it to its members. Determining the cost of the option is complex. In the 31 December 2005 actuarial valuation, the cost of the two track was estimated by the Plan's actuary by increasing the liabilities of the Fund by an amount sufficient to increase the cost of the Fund by 1.9% of payroll. This resulted in a 5.73% increase in Fund liabilities.

62. At the outset of the ALM Study, it was decided that PCA/EFI would include the two track feature in the CASSY® model directly, with the goal of testing the current methodology. To this end, we included in the CASSY® Asset Model the capacity to simulate international exchange rates and international inflation; the CASSY® Benefit Model was enhanced to compute payments under the two track. In addition, the Model was enhanced to allow benefit simulations both with and without the two track, enabling a comparison.

63. The result of these efforts is shown in Figures 8 below and 9 on following page.

Figure 8 - Simulated Benefits as a Percentage of Active Payroll – No Two Track

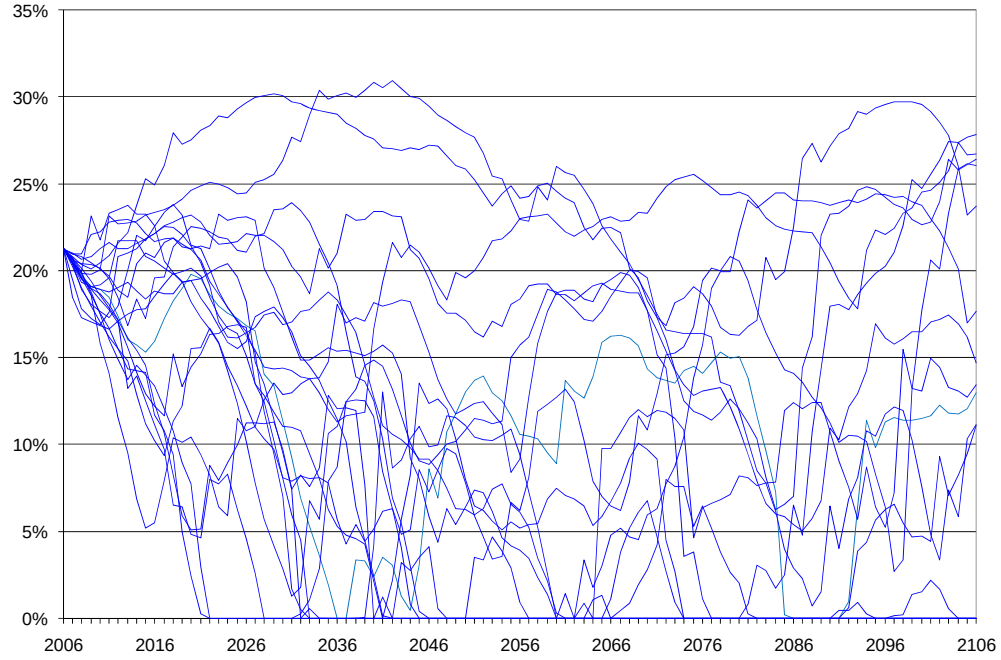


The horizontal axis is time in years; 100 years are shown. The vertical axis is benefit payments as a percentage of active payroll. 100 simulation trials were performed; 20 of them are shown in blue. The red line is the average cost of the 100 trials.

64. Figure 8 shows a simulation of Fund benefits with a cost of living adjustment depending only on U.S. inflation; the two track feature is not included. We note two features of the graph. First, when we compare this simulation with Figure 5, we note there is much more variation in benefits due to the two track feature. Second, we note in Figure 5 – simulated *with* the two track feature – that there is an indication of higher average benefits, as a percent of pay. More specifically, benefits appear to increase at a more rapid pace under the two track feature, until they level out at a higher level in the distant future.

65. A simulation of the Fund cost without the two track is shown on the next page, in Figure 9.

Figure 9 - Simulated Actuarial Cost as a Percentage of Active Payroll – No Two Track



The horizontal axis is time in years; 100 years are shown. The vertical axis is total actuarial cost as a percentage of active payroll. 100 simulation trials were performed; 20 of them are shown in blue.

66. While quite volatile, the average projected actuarial cost in Figure 9 is somewhat lower than that shown in Figure 6, *with* the two track.

67. Taken together, the results of Figures 8 and 9 suggest that the two track cost impact may be higher than the 1.9% level assumed previously: As the simulations suggest, both benefit payments, which drive liabilities, and ultimate average costs are impacted.

68. Nonetheless, given the uncertainties, the difference between the cost indicated by simulation of the two track and the cost produced by the current load factor practice is not unexpected. There are three caveats that should be acknowledged:

a) The ALM Study is not a two track study. We have not attempted to model every aspect of the two track benefit which, itself, is highly complex and difficult to model. In particular, we have not modeled the opportunity for retiring members to join the two track system well after their retirement, based on exchange rates then prevailing.

b) We have assumed a utilization rate of 35% in the two track. Following the introduction of the 110% cap there has been steady reduction in the overall utilization rate of the two track feature from 35.6% in 1996 to 27.5% as 2003. However, due to the most recent drop in relative value of the U.S. dollar vis-à-vis other currencies, the overall utilization rate increased to 30.5% in 2005. The utilization rate since the introduction of the 110% cap (1995-2005) has been 24.8% in the cited period. Therefore, we have made some allowance for future

two track elections that was probably not included in the cost estimation of the two track.

c) Finally, the cost of the two track system is highly variable, depending on the interplay of U.S. and worldwide inflation rates, currency exchange rates, and the behavior of Fund members. Consequently, any cost estimate must be viewed critically, and no matter how carefully the estimate is prepared, the actual cost experience of the two track sysetm can be expected to vary widely from the estimate.

d) Nonetheless, and as indicated earlier, uncertainties inherent in the two track feature of the Pension Adjustment System do not warrant a firm recommendation that the current load for the two track feature (i.e. 1.9%) be changed immediately. What can be recommended is continued and careful monitoring of such costs in conjunction with the periodic actuarial valuations.

Chapter V
Modeling of Major Asset Classes in the UNJSPF A-L Model

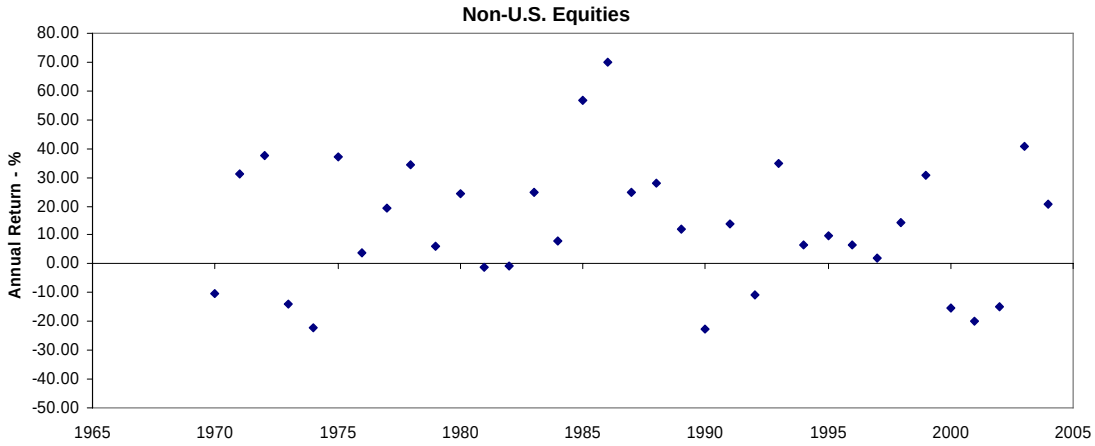
Overview of PCA/EFI Asset Class Modeling Process

69. As highlighted previously, the PCA/EFI asset-liability modeling process utilizes a stochastic simulation-based approach. Stochastic simulation techniques come in two general forms: re-sampling and Monte Carlo. Under re-sampling, the simulation technique utilizes various forms of random sampling from a *previously established dataset*. For example, a re-sampling technique might collect data from the sample and then replace that data back into the sample for future collections (this is called "re-sampling with replacement"). Or, the re-sampling technique might collect data from the sample only once and not reuse it. Monte Carlo techniques, on the other hand, utilize pre-established *distribution models* to create simulations. Examples of such distribution models include the i) normal distribution, ii) lognormal distribution, iii) uniform distribution, iv) binomial distribution, etc. Once a distribution model is selected and specified, simulated data collections from that distribution model can occur. A key difference between re-sampling and Monte Carlo is that under re-sampling there is no presumption about the distribution of the data.

70. The PCA/EFI model utilizes re-sampling with replacement. A key requirement of this technique is an appropriate data set from which to resample. The data set utilized by PCA/EFI consists of 38 years of annual passive real return history for several asset classes considered by the UNJSPF. The simulation process begins by randomly selecting a specific year from within this 38 year history to collect asset class returns. The annual real returns of the asset classes of interest are then stored and another yearly sample is taken and appended to the first year's collected data, and so forth, until a full time series of asset class return data is collected, reflecting the desired time horizon. This process is then repeated hundreds, if not thousands of times to create a range of possible investment scenarios (see Figure 10, next page). Once these scenarios are created, every single possible portfolio combination of asset classes is analyzed to gauge their respective potential impacts upon the financial condition of the pension plan.

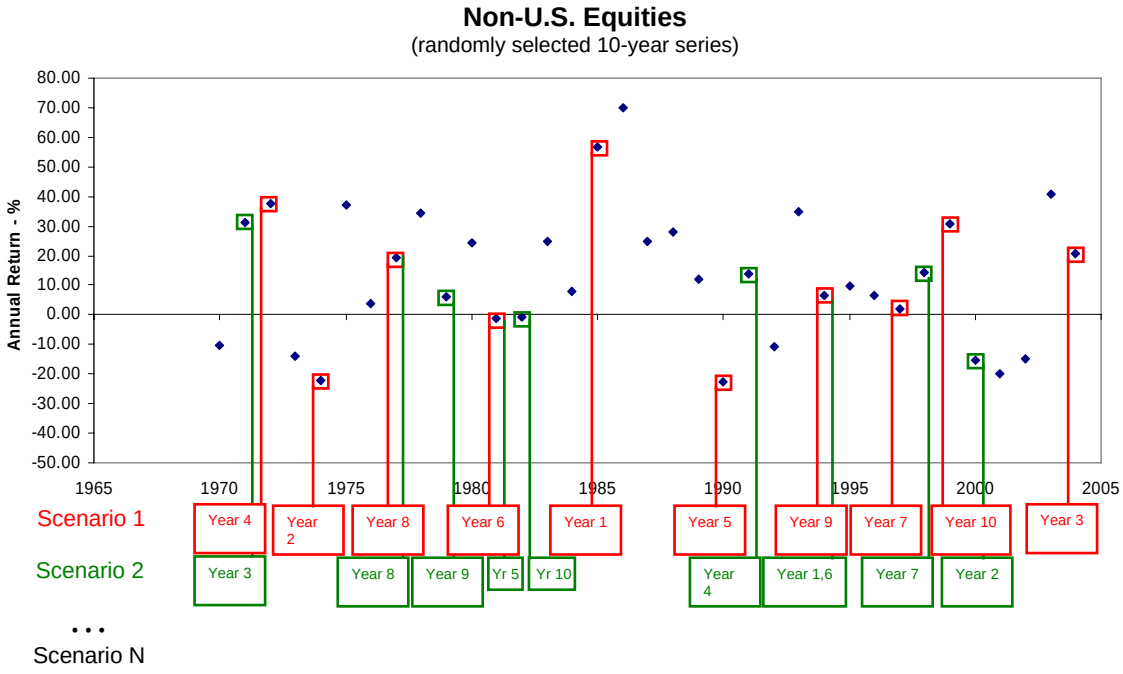
Figure 10 – PCA/EFI Re-Sampling Technique

Step 1: Begin with a time series of real returns…



Source: PCA/EFI

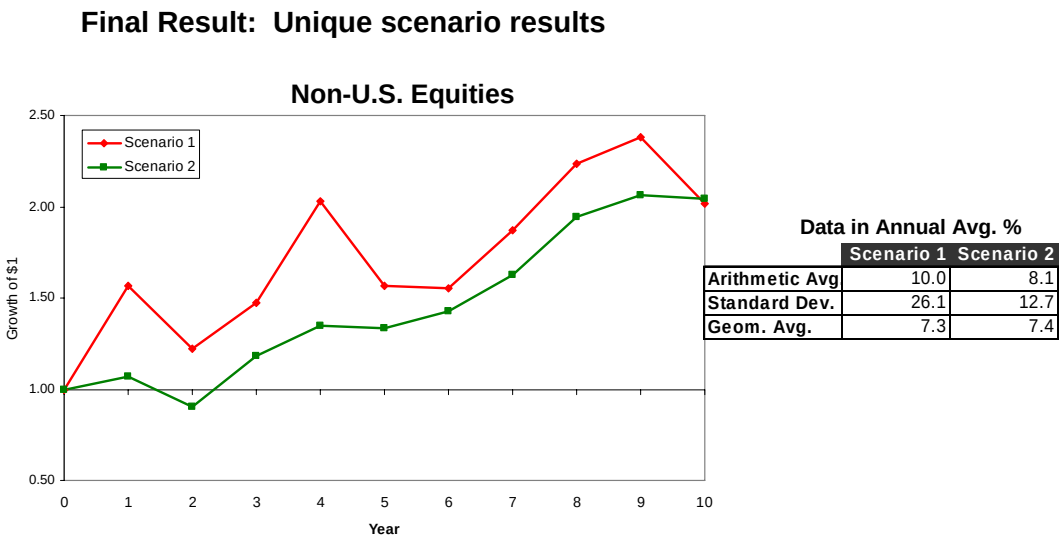
Step 2: Randomly select a fixed set of years many times (each set is a "scenario")…



Source: PCA/EFI

71. Each time series scenario is then geometrically linked over time. As one might expect, each scenario displays different return patterns, different average returns, and different volatilities (see Figure 11, next page).

Figure 11 – PCA/EFI Re-Sampling Technique



Source: PCA/EFI

72. To create nominal returns, these passive real return time series are combined with an inflation time series that is pre-specified based on actuarial assumptions and/or user preferences. The inflation component is allowed to fluctuate based on a serial correlation variable. This serial correlation variable reflects empirical evidence that inflation tends to move in long-term trends and, in that respect, is not a truly random variable. Both the level of inflation and its serial correlation are user-defined inputs in the PCA/EFI system. This feature allows users to adjust one or both inputs for sensitivity analysis purposes.

73. Importantly, while the dataset is historical in nature, each asset class time series is adjusted to reflect PCA/EFI's forward-looking return expectations for each asset class. Once PCA/EFI's mean-variance passive asset class assumptions are developed, the averages for each historical real return time series in the dataset are compared to the mean-variance *expected* average annual real return for each respective asset class. If the difference between an asset class's historical average passive return from the dataset and its expected assumed passive return is material (i.e., greater than 25bp per year), then PCA/EFI will adjust that time series in the dataset accordingly. For example, if the historical average real return of U.S. Equities was 8.5%, but PCA/EFI's expected forward-looking real return for U.S. Equities is 5.0%, then each annual observation in the historical U.S. Equities dataset time series would be adjusted downwards by (3.5%).

74. Historical volatilities and correlations are not adjusted, for different reasons. Long-term volatilities are considered the most stable of the three modeled variables in mean-variance space (returns, volatilities (risk), and correlations). Modeled volatilities are typically considered equivalent to historical volatilities over long planning horizons. Correlations, on the other hand, can vary significantly within an investment horizon. The standard mean-variance optimization process assumes both standard deviations and correlations remain stable over the entire horizon, while re-sampling procedures allow these variables to fluctuate within the horizon, depending on the data selected.

Descriptive and Background Information on UNJSPF Asset Classes

75. This section reviews several aspects of the investment assets utilized in the UNJSPF modeling process. To develop asset class inputs used by the asset-liability model, PCA/EFI and UNJSPF staff engaged in several rounds of discussions covering numerous asset-related issues (such as asset class inclusion, asset class structure, investable ranges for asset classes, implementation issues, hedging currency risk, etc.). Consensus views on these asset-related input parameters arose from these discussions. What follows is a summary of how key asset-related parameters are incorporated into the modeling process.

Asset Classes Utilized by UNJSPF

76. After significant deliberation, a consensus developed to model passive expected returns for the following seven classes as discrete asset classes:

a) Global Developed Markets Equity
b) Global Developed Markets Investment Grade Fixed Income
c) Global Emerging Markets Equity
d) Global Emerging Markets Fixed Income
e) Real Return Assets
f) Real Estate
g) Private Equity

77. The UNJSPF invests currently in five of these asset classes, with the Real Return and Private Equity classes being considered for the first time. The Real Return asset class is actually a collection of smaller underlying asset segments and investment strategies that the UNJSPF would utilize to create an asset class whose objective would be to generate a stable real return with a high degree of confidence. Asset segments within this asset class might include, but are not limited to: inflation-protected fixed income securities (TIPs), timber, commodities, infrastructure, and low volatility hedge fund strategies. An important assumption in structuring this asset class is that the UNJSPF would establish a core position of TIPs (due to their real yield and liquidity features) and then opportunistically invest in the other asset segments to the extent that they prove complementary to the TIPs position and are underwritten to meet the real return objective.

78. The Private Equity asset class is a high return-oriented asset class that would likely have significant allocations to buyout, venture capital, mezzanine, restructuring, and distressed investment strategies. Such strategies are typically offered through the private marketplace, making this asset class relatively information inefficient and resource intensive. From a geographic perspective, the Private Equity asset class, if funded, would evolve over time in a fashion similar to that of the UNJSPF's Real Estate asset class. The UNJSPF real estate portfolio currently has a significant global focus reflecting the globalization of the overall institutional commercial real estate investment markets. Similar trends are unfolding within Private Equity.

79. Importantly, all asset classes have large scale institutional-oriented investment markets enabling the UNJSPF to participate at a meaningful level (each asset class has at

least $1 trillion of market value). Further descriptions of these asset classes and their accompanying implementation issues can be found in the Annex section of this report.

Investment Constraints Incorporated Into Asset-Liability Model

80. From a strategic perspective, each asset class under consideration should attract a large enough proportion of the policy portfolio to have a meaningful impact upon the overall policy portfolio's risk-adjusted return. In contrast, existing policy allocations should not be changed too dramatically; it is important to (i) protect the integrity of the overall investment program and (ii) keep potential frictional transition costs to a minimum. Finally, the implementation of certain asset class investment programs (such as Private Equity) can be highly resource intensive, even at smaller allocation levels. Therefore, scaling into such asset classes over time may prove to be an effective and viable approach. Keeping all these factors in mind, PCA/EFI, with considerable input from UNJSPF Staff, developed the following set of allocation constraints for use in the model:

Figure 12 – A-L Modeling Constraints with Reference to Current Policy

	Range of Potential Allocations			
	Minimum	**Maximum**	**Current Policy**	**Potential Change**
Global Dev Markets Equity	47	63		
Global EM Equity*	3	7		*
Total Equity	50	70	60	17%
Global Dev Markets Inv Grade Fixed Income	26	32	31	16%
Global EM Fixed Income*	0	4		*
Total Fixed Income	26	36	30	
Real Return Assets	0	3	0	new
Real Estate	5	7	6	17%
Private Equity	0	3	0	new
Short-Term	3	3	3	0%

* Current policy includes these segments within broader asset class; the A-L Study considers these classes as new discrete asset classes.

81. These ranges indicate that 84% of the portfolio will be allocated based on required minimum levels. As a result, the asset-liability study will focus on where best to allocate the remaining 16%. This 16% could be allocated to new or existing asset classes depending on (i) the UNJSPF's risk tolerance and (ii) the model's optimal allocation in light of that risk tolerance. As the far-right column indicates, there is potential for significant change across all asset classes (for example, the overall allocation to public equity could rise/decline by a maximum of 17% of its current value, depending on the policy portfolio selected).

82. The 3% limit on the two new asset classes (Private Equity and Real Return) is a compromise between ensuring reasonable scale to provide a meaningful impact and keeping the initial allocations to these new and potentially illiquid assets within manageable limits. Any allocation to these asset classes will likely prove challenging to fund over the next several years as they are (i) new asset classes, (ii) consist largely of privately held vehicles that fund over time rather than immediately (which is the case with public market equity and public market fixed income mandates) and (iii) will require significant resource and procedural adjustments on the part of the UNJSPF. In addition, 3% of the UNJSPF's $35 billion in current assets, amounts to over $1 billion in initial allocation to one or both of these programs. Such a level is considered reasonable and appropriate in terms of initiating a new asset class. See the Annex for further discussion on these matters.

Overview of Currency Risk within an Asset-Liability Context

83. There has been significant research conducted exploring the impact and management of currency risk on investment portfolios.[1] In light of this research, the debate continues about whether explicit currency management adds long-term risk-adjusted value to a diversified investment portfolio.[2]

84. Currency management can be broken into two major areas: (i) *strategic currency hedging*, where there is a process utilized to determine whether some level of static long-term currency hedging is useful primarily from a risk management perspective and (ii) *active currency management*, which consists of numerous investment strategies that seek to invest actively in currencies in order to add value over an otherwise base-currency cash return.

85. The research on strategic currency hedging has reached mixed conclusions. One position is that, as multi-currency portfolios grow in scale, currency risk also becomes significant requiring some level of management to reduce such risk. Considering this position, numerous practitioners and academics have attempted to develop procedures to identify an optimal static long-term hedge ratio for a specific multi-currency investment portfolio. Underlying this exercise is the assumption that risk associated with currency volatility is (i) necessarily bad for the portfolio once a certain proportion of non-base currency exposure is reached and (ii) that currency risk is material.[3]

86. A contrasting position is that currency returns are so volatile and so "noisy" that utilizing a static long-term hedge ratio is unwarranted.[4] In addition, once currency risk is hedged away from a certain asset class, that asset class's underlying volatility may still prove to be significant, rendering the strategic hedge's benefits unclear.[5] Finally,

[1] See, Currency Management Handbook, Barclays Global Investors, 2002.

[2] For contrasting views, see Nesbitt, Stephen L., "Currency Hedging Rules for Plan Sponsors," Financial Analysts Journal, March-April 1991; Gardner, Grant and Stone, Douglas, "Estimating Currency Hedge Ratios for International Portfolios," Financial Analysts Journal, November-December 1995; and Nordquist, Greg and Castelin, Mark, "Currency Hedging Policy for US Investors," Practice Note 87, Russell Investment Group, October 26, 2004.

[3] *Ibid*, Nesbitt.

[4] *Op Cit*, Stone and Gardner.

[5] "Currency and Currency Management," Pension Consulting Alliance, September 2005.

currency hedging may alter volatility to such a degree that the hedged asset class's resulting investment return correlations or co-movements with other asset classes actually rise, rendering the diversification contribution of currency hedging inadequate.

87. In contrast, active currency management should be viewed, not in the context of an asset-liability study, but rather as another potential approach to adding value either within or across certain asset classes. Under this approach, considering specific active current management approaches would then be analogous to considering any other form of active management.

Incorporation of Currency Hedging in the Modeling Process

88. In light of the potential for using the above asset classes, the PCA-EFI asset-liability model also allows for the contemplation of the impact of strategic currency hedging upon UNJSPF investment portfolio. Specifically, the model allows up to 100% hedging into U.S. Dollars for the Global Developed Equity, Global Fixed Income, Global Emerging Markets Equity, and Real Return asset classes.[6] The return pattern and volatility differences associated with the unhedged and hedged Global Developed Markets Equity and Global Fixed Income asset classes are material enough to be tested and analyzed through the modeling process.

89. The volatility differences of the unhedged and hedged Global Emerging Markets Equity and Real Return asset class are less significant for several reasons.[7] First, for much of its history, emerging markets equities investment returns were largely directly linked to the U.S. Dollar, but over the last several years, this pattern has changed.[8] However, hedging emerging markets equities is still extremely difficult given the high volatility of currencies and interest rates in certain markets,[9] as well as the paucity of instruments available to hedging emerging market currency risk (this is the case for emerging markets fixed income as well).[10] Second, with respect to the Real Return asset class, it is a combination of various asset types (global TIPS, hedge fund of funds, commodities, timber, and potentially infrastructure) that have heterogeneous exposures to currency risk. With respect to global TIPS, we model those on both an unhedged and hedged basis. Hedge fund of funds are absolute return oriented irrespective of currency exposure, and timber strategies often incorporate currency hedging similar to private equity and real estate. As a result of these factors, it is likely that asset class-level strategic hedging applications for these asset segments will prove impractical for the foreseeable future. Still, the modeling process incorporates a modest degree of hedging potential for the latter asset classes.

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[6] The methodology is equivalent, in concept, to the one-step strategic asset allocation process that includes potential hedging discussed in the Currency Management Handbook. See footnote 1.

[7] See, Bruner, Robert, Conroy, Robert, Li Wei, O'Halloran, Elizabeth, Palacios Lleras, Horatio, Investing in Emerging Markets, Chapter 5, The Research Foundation of AIMR, August 2003. The authors show that currency fluctuations are not generally a significant contributor to the level of country market risk across 31 different emerging country equity markets, although there is significant variation by country market.

[8] Sources: UBS Asset Management, JP Morgan EMD Indices, Bridgewater.

[9] See, Errunza, Vihang, "Research on Emerging Markets: Past, Present, and Future," Emerging Markets Quarterly, Vol 1, No 3 (1997).

[10] See, Fong, Gifford, "Currency Risk Management in Emerging Markets," Emerging Markets Quarterly, Vol 1, No 3 (1997).

90. For the remaining asset classes (Emerging Markets Fixed Income, Real Estate, and Private Equity) there is no distinction between hedging and not hedging. As discussed previously, the Emerging Markets Fixed Income asset class faces equivalent hedging challenges as with emerging markets equity.[11] Therefore, hedging emerging market debt is not considered. Real Estate and Private Equity share a similar feature in that they typically already carry significant portions of financial leverage (e.g., opportunity funds in real estate and buyout funds in private equity). Assuming the leverage is denominated in local currencies, such leverage acts as a "natural hedge" that is already embedded in the "unhedged" returns. Given this natural hedge, there is less of a need to hedge these asset classes further. In addition to financial leverage, depending on the strategy involved, certain of UNJSPF's portfolio managers are already hedging out currency risk (e.g., Lone Star funds). As a result of these features, there is no need to try to impute an implied hedge ratio upon these asset classes.

91. Given the above issues, the PCA-EFI algorithm for strategic hedging still allows for potential hedging across approximately 90% of the UNJSPF investment portfolio, based on current asset allocation policy. In addition, the modeling process allows the UNJSPF to consider the strategic hedging of specific asset classes if evidence indicates that hedging one asset class or a subset of asset classes would prove beneficial to policy.

Developing Historical Time Series Models for Specific Asset Classes

92. As discussed previously, the PCA-EFI asset-liability model utilizes statistical resampling procedures to create thousands of investment scenarios in order to stress test potential policy portfolios and projected plan cash flows and liabilities. To ensure the re-sampling process is robust, the initial sample of time series data should be lengthy enough to incorporate a reasonable range of market environments and investment cycles. PCA/EFI's asset database utilizes data on asset classes going back to 1970. Extending farther back in time does not occur for two reasons: (i) prior to 1970, data on various asset classes is extremely limited and (ii) prior to 1970, most currency values around the world were tied to the value of gold (i.e., the "gold standard"). These valuation standards began shifting dramatically to "floating" valuations in late 1971 following the Smithsonian Agreement ratified by the Group of Ten countries in December of that year.

93. Of the seven asset classes considered by UNJSPF, four asset classes did not have historical data back to 1970. These asset classes are: Global Developed Markets Investment Grade Fixed Income, Emerging Markets Fixed Income, Emerging Markets Equity, and several components within the Real Return asset class (TIPs, infrastructure, commodities, hedge fund of funds all do not have historical data going back to 1970). For these asset classes, PCA developed modeled time series to cover the missing years going back to 1970. For example, in the case of both Global Developed Markets Investment Grade Fixed Income and Global Emerging Markets Fixed Income, PCA relied upon asset class models created by Bridgewater Associates, one of world's leading currency and global fixed income asset managers. In certain cases, PCA had to create its own asset class return models. This was the case for approximately one-half of the Emerging Markets Equities historical sample and for the earlier years of Emerging

[11] See, Johnson Ceva, Kristin, "Finding Opportunity in Emerging Market Debt," CFA Institute Proceedings, June 2006.

Markets Fixed Income asset class. In addition, the Real Estate asset class was modeled to exhibit the unique characteristics of the UNJSPF real estate portfolio, which is global in nature, allows financial leverage, and invests in several non-core real estate vehicles. The historical dataset used for all asset classes, with accompanying explanations can be found in the Annex. As described elsewhere in this report, expectations for the asset classes assume, for the most part, that asset class portfolios are managed passively. Added value considerations and implementation of various active management approaches are considered beyond the scope of this project, although we do outline several related issues in Annex II. We note, however, that it is extremely difficult to create strictly passive portfolios in certain asset classes, such as real estate, private equity, and the proposed real return asset class.

Asset Class Return, Risk, and Correlation Assumptions

94. PCA develops expected return, risk, and correlations assumptions for several asset classes, including those utilized in this study on behalf of the UNJSPF. The objective of PCA's assumption development process is to arrive at reasonable consensus-oriented expectations. PCA's process does *not* focus on developing added value or tactical views about the prospects for asset classes.

Assumptions developed for the UNJSPF Project

95. The assumptions for the UNJSPF-specific asset classes appear in the table below:

Figure 13 – UNJSPF Mean-Variance Asset Class Assumptions

	Expected Avg. Nominal Annual Return	Expected Risk of Nominal Returns (Annlzd. SD)	Sht Term	Glbl Fxd	EM Fxd	Real Est	Real Ret	Glbl Eq	EM Eq
Short-Term	4.00	2.0							
Global Developed Markets Fixed Income	5.25	8.0	0.00						
Emerging Markets Fixed Income	5.75	12.5	0.00	0.10					
UN Real Estate	8.90	17.0	0.20	-0.25	0.10				
Real Return	7.50	9.0	0.00	0.00	0.70	0.00			
Global Developed Markets Equities	9.00	15.0	0.00	0.10	0.10	0.30	0.00		
Emerging Markets Equities	10.00	30.0	-0.25	-0.20	0.40	0.20	0.35	0.55	
Private Equity	12.50	32.0	0.00	-0.15	0.30	0.10	0.15	0.75	0.65

96. These assumptions are used as a baseline for the asset-liability modeling process. Further detail on these assumptions and the assumption development process can be found in Annex I. None of these assumptions are used explicitly to determine and test optimal portfolios. Rather, these assumptions are used to adjust the PCA/EFI dataset, which is then used in the resampling process. This adjustment process was discussed in the Overview section of this chapter.

Chapter VI
The Process for Setting Risk Tolerance

Background

97. The previous chapters focused on asset-liability concepts and the development of a customized asset-liability model for the UNJSPF pension plan. This asset-liability model provides UNJSPF decision makers with an excellent understanding and awareness of the risks associated with overall plan financial performance. Given a fully-developed asset-liability model, the key consideration for decision makers then becomes the defining and quantifying of their consensus risk tolerance. Once an appropriate definition and level of risk tolerance is established, the PCA/EFI asset-liability model can then identify quantitatively an ideal/optimal asset allocation mix (i.e., policy) that best addresses that consensus risk tolerance. Depending on the policy outcome generated by the model, UNJSPF decision makers may elect to modify the proposed policy for unique implementation-related concerns that the model has difficulty capturing. Nonetheless, risk tolerance is the most critical variable that allows decision makers to screen through thousands of portfolio choices to arrive at a limited spectrum of viable policy options. The patented CASSY® asset-liability model gives decision makers an intuitive approach to defining and quantifying their unique tolerance for risk.

98. This chapter provides detail on how the customized CASSY® asset-liability model was utilized by the UNJSPF ALM Steering Committee to develop a refined set of risk tolerance choices for further consideration. As discussed above, each risk tolerance choice is linked directly to an investment policy that best reflects that risk tolerance. We review specific investment policy options in the following chapter.

Quantifying Risk Tolerance Through the Use of Decision Factors

99. In more standard approaches to asset-liability modeling, investment portfolios are typically selected based on whether they (i) achieve a minimum of the assumed actuarial rate of return and (ii) produce the lowest level of volatility for that level of return. In these standard approaches, the volatility of the investment returns is traditionally used as a proxy for risk. Decision makers may include and consider other higher-returning / higher-risk portfolios as other options. Once these options are analyzed (typically in relation to current policy), one policy option is selected for further analysis to determine how it might impact the future financial condition of the plan. Typically, there is virtually no analysis of how the broad spectrum of other potential policy options might impact overall plan financial risk. This sequential process of first selecting a policy portfolio based only on investment return and then analyzing how it impacts the financial condition of the plan is suboptimal and backwards. Rather, decision makers should determine their sensitivities about overall plan risk *first and then* select an appropriate policy portfolio based on those views of plan risk. In this respect, the tolerance for plan risk becomes *integrated* into the policy selection process rather than being treated only as a form of a feedback loop at the end of the process. This integrated approach is the focus of the PCA/EFI CASSY® model.

100. To begin the plan risk-framing process, PCA/EFI works closely with plan decision makers to explicitly identify key plan risk parameters that reflect the specific sensitivities associated with the plan in question. While there are numerous risk variables to choose from, typically two variables are of particular importance and warrant measurement and analysis. These variables are: (i) the plan's projected funding level and the projected path that funding level might take in the future, and (ii) the projected level and volatility of annual employer costs required to fund the plan.

101. As might be expected, these basic plan risk measures involve tradeoffs: A high funding level might be achieved at the cost of an unsustainably high employer contribution or high contribution volatility. Conversely, seeking low employer cost may result in a deterioration and/or increased volatility of a plan's funding level. In addition, a low *average* employer cost may involve high annual *variability* in that cost.

102. To try to capture and quantify plan risk sensitivities associated with the UNJSPF Plan, the project ALM Steering Committee identified four customized Decision Factor groups after significant discussion with PCA/EFI. These Decision Factor groups may be regarded as general objectives that focus on keeping overall UNJSPF Plan financial risk within an acceptable range and/or manageable level. In addition, they constitute a coherent risk-management framework that considers the main concerns expressed over the years by the Pension Board and General Assembly. Thousands of portfolio candidates were then scored (i.e., ranked) in terms of how each performed in relation to each specific Decision Factor. The Decision Factor groups utilized by the UNJSPF are:

1. Keep Plan costs within an acceptable range. Portfolios were scored higher if they kept annual costs within a range of 10% to 23.7% of payroll. This range considers the current contribution rate as the ceiling amount. The lower limit was determined based on initial simulations of plan cost (see Chapter IV).

2. Maintain and improve the funded status of the Plan. Portfolios were scored higher if they (i) exhibited higher probabilities of producing higher funding levels over time and (ii) if they reduced the chance of producing a funding ratio of less than 85%.

3. Produce acceptable levels of non-negative real returns. Portfolios were also scored based on two real return factors. First, the higher a portfolio's average real return, the higher its score. Second, after discussion with the Steering Committee, portfolios were scored lower the more often their annual real return was negative for three consecutive years.

4. Maintain adequate solvency over time. Portfolios were scored higher if they produced a higher assets-to-benefits ratio over time. In contrast, if a portfolio caused the assets-to-benefits ratio decline below a level of 15 over time, then that portfolio received a lower score.

103. The above Decision Factor groups constitute a set of multiple competing objectives. The goal is to optimize the financial performance of the UNJSPF Plan relative to these objectives by choosing an appropriate asset allocation. Consequently, this approach represents a classic engineering multi-objective optimization project.

104. Prior to the meetings with the ALM Steering Committee, PCA/EFI analyzed approximately 10,000 different potential policy allocations under 1,000 randomly generated investment return scenarios (see Chapter 3 for an explanation of this process). As each portfolio is simulated through the numerous investment scenarios, it is scored for each Decision Factor. The scores derived for each Decision Factor can then be weighted based on UNJSPF preferences. The aggregate weighted scores for each portfolio then determine whether a specific portfolio is optimal. As might be expected, the optimal portfolio can change depending on how the ALM Steering Committee collectively determines to weight each Decision Factor in the scoring process.

105. PCA/EFI and the ALM Steering Committee spent multiple sessions examining numerous simulations associated with testing and analyzing the above Decision Factor groups separately and in weighted combinations to determine an appropriate combination of risk management objectives. After significant analysis, the ALM Steering Committee formulated three precisely-defined risk tolerance "philosophies" believed to (i) represent a reasonable spectrum of risk management positions available to the UNJSPF and (ii) include the potential to produce relatively contrasting asset allocation policies for consideration by the Secretary-General, Investment Committee, Committee of Actuaries and the Pension Board (see table, next page).

Figure 14 – Risk Tolerance Philosophies

Risk Tolerance Philosophy	Description of Risk Variables Utilized
Neutral	*Includes all Decision Factor groups described above.* All Decision Factors are weighted equally when screening for asset allocation policies. This risk tolerance philosophy represents a neutral position from which to assess the other philosophies.
Prudent Funding	*Places a high priority on improving the funded status of the plan while also focusing on protecting the long-term plan solvency.* Specifically, a 50% weight is placed on portfolios that score high with respect to achieving a high funded ratio over time; a 25% weight is placed on portfolios that score high with respect to keeping annual plan costs below a 23.7% of pay maximum threshold; the final 25% weight is placed on portfolios that score high with respect to maintaining the assets-to-benefits solvency ratio above a 15 year threshold.
Return-oriented	*Places a high priority on achieving a favorable long-term real return while stressing the importance of avoiding sustained negative real returns.* Specifically, a 50% weight is assigned to the score relating to the level of the portfolio's average real return. The higher the real return, the higher the score. The other 50% weight is placed on portfolio scores relating to their expected frequency of avoiding producing a negative 3-year real return.
Defensive	*Places a high priority on maintaining low plan cost volatility and avoiding deterioration in the long-term solvency of the UNJSPF Plan.* Four equally-weighted Decision Factors are utilized to score and rank potential policy portfolios, one from each Decision Factor group discussed above. The four factors are: (i) keeping annual plan costs below the 23.7% pay level, (ii) keeping the Plan's funding ratio above a minimum 85% threshold level, (iii) avoiding negative real returns over trailing 3-year periods, and (iv) maintaining the assets-to-benefits solvency ratio above 15 years.

106. The CASSY® asset-liability utilized the above risk tolerance philosophy framework to identify specific candidate policy portfolios that best meet each specific risk tolerance philosophy's intentions. This range of resultant investment policies are described in the next chapter.

Chapter VII
Investment Policy Recommendations and Conclusions

107. As discussed in the prior chapter, PCA/EFI and the ALM Steering Committee worked closely together to develop a customized risk management framework that best represents the unique financial aspects of the UNJSPF Plan. This framework allowed the ALM Steering Committee to effectively articulate a spectrum of risk tolerance views (in the form of "risk tolerance philosophies") that are critical to the selection of potential asset allocation policies. This chapter presents and discusses these candidate asset allocation policy options.

Asset Allocation Policy Selection Process

108. As discussed in the prior chapter, four risk tolerance philosophies were established for the purpose of considering a range of potential asset allocation policies. These risk tolerance philosophies are:

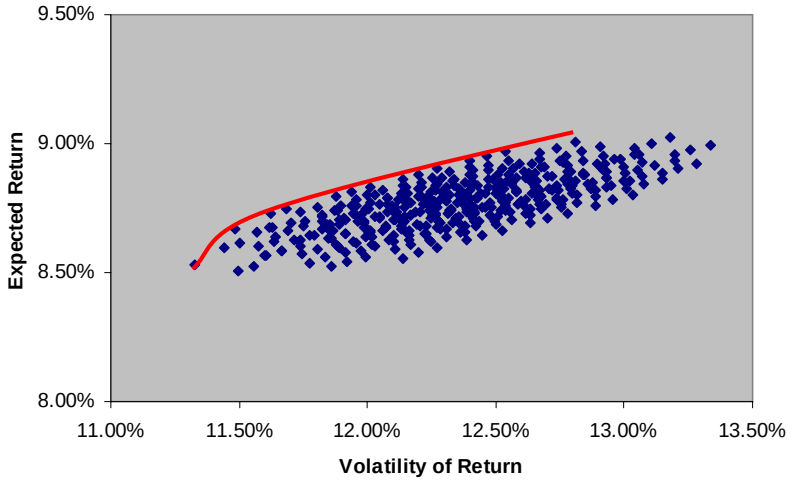
a) Neutral
b) Prudent Funding
c) Return-Oriented
d) Defensive

109. Each risk tolerance philosophy reflects a certain viewpoint about what the UNJSPF should emphasize in terms of managing overall Plan financial risk. If the UNJSPF believes risk management should focus on enhancing the funded status of the Plan over the long-term, then the "Prudent Funding" risk philosophy should be viewed as most appropriate. If Plan solvency and cost volatility management are the highest priorities, the "Defensive" risk philosophy should be adopted.

110. There is a direct linkage between each risk tolerance philosophy and an optimal asset allocation policy (see prior chapter). The PCA/EFI CASSY® asset-liability model quantitatively identifies these optimal policy portfolios through the portfolio scoring process described in the prior chapter.

111. For example, under traditional optimization procedures, portfolios are typically ranked across two dimensions, the expected risk of a portfolio (investment return volatility is used as a proxy for investment risk) versus its expected return (see chart below).

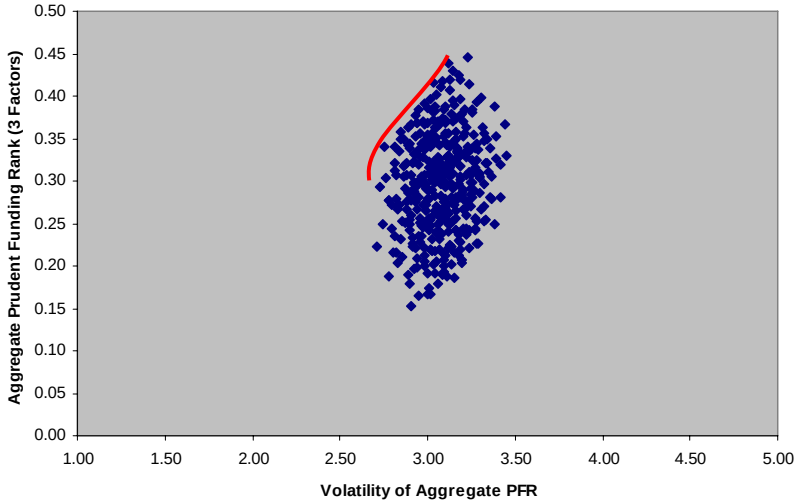
Figure 15 – Efficient Frontier, Traditional Mean-Variance Approach



112. Portfolios that exhibit the highest expected return at a given level of risk reside on the "efficient frontier" (see red line). The efficient frontier also represents portfolios that exhibit the lowest risk portfolios for a given level of expected return.

113. The above graph is a special single-variable case (i.e., return and its volatility) that can be generalized to cover multiple risk factors (i.e., Decision Factors). For example, the graph below plots aggregated portfolio scores based on the Prudent Funding philosophy discussed earlier. As presented, the Prudent Funding philosophy utilizes scores from three Decision Factors (cost volatility, funding progress, and plan solvency).

Figure 16 – Modified Efficient Frontier, CASSY® Multi-Factor Approach



114. As the graph highlights, portfolio selection takes on a different form and shape, depending on the risk factor(s) selected. In addition, the efficient frontier changes, as do portfolios that reside on the efficient frontier. The important point is that a portfolio that resides on the traditional Mean-Variance efficient frontier may, in fact, prove to be suboptimal under the multi-factor optimization approach. Determining optimal policies using the previously highlighted risk tolerance philosophies incorporates the multi-factor approach to optimal policy portfolio selection.

Recommended Asset Allocation Policies for Each Risk Tolerance Philosophy

115. Based on the process and framework highlighted above and in the prior chapter, PCA/EFI and the ALM Steering Committee arrived at a proposed optimal asset allocation policy for each risk tolerance philosophy (see charts below). These policies reflect two asset class frameworks: (i) assuming the use of current asset classes only and (ii) utilizing an asset class structure that contains four new discrete asset classes (two of which are currently considered major segments within the broader current set of asset classes).

Figure 17 – Recommended Asset Allocation Policy by Risk Tolerance Philosophy

Panel A – Utilizing Current Asset Classes Only, Unhedged

	Optimal Asset Allocation - %										
Risk Tolerance Philosophy	**Global Equity**	**EM Equity**	**Total Public Equity**	**Global Fixed**	**EM Fixed**	**Total Public Fixed**	**Real Estate**	**Priv Equity**	**Real Return**	**Short Term**	**Total**
Prudent Funding	57	7	**64**	26	0	**26**	7	0	0	3	**100**
Return-Oriented	55	6	**61**	29	0	**29**	7	0	0	3	**100**
Defensive	54	3	**57**	32	1	**33**	7	0	0	3	**100**
Current Policy	55	5	**60**	31	0	**31**	6	0	0	3	**100**

Panel B – Incorporating New Discrete Asset Classes, Unhedged

	Optimal Asset Allocation - %										
Risk Tolerance Philosophy	**Global Equity**	**EM Equity**	**Total Public Equity**	**Global Fixed**	**EM Fixed**	**Total Public Fixed**	**Real Estate**	**Priv Equity**	**Real Return**	**Short Term**	**Total**
Neutral	47	7	**54**	30	0	**30**	7	3	3	3	**100**
Prudent Funding	51	7	**58**	26	0	**26**	7	3	3	3	**100**
Return-Oriented	53	7	**60**	26	0	**26**	5	3	3	3	**100**
Defensive	47	3	**50**	32	2	**34**	7	3	3	3	**100**
Current Policy	56	5	**61**	30	0	**30**	6	0	0	3	**100**

116. Panel A above indicates that, if the UNJSPF determines to remain with its current set of asset classes, then there are potential shifts in policy, based on the risk tolerance philosophy. As Panel A shows, there is no material difference between Current Policy and the Return-Oriented risk tolerance philosophy. To the extent that the UNJSPF desires to adopt one of the other risk tolerance philosophies, optimal allocations among existing asset classes should also change. For example, under the Prudent Funding risk tolerance philosophy, overall allocation to Public Equity increases with a commensurate reduction in Total Public Fixed Income. Allocation to the emerging markets equity

segment maintains its approximate market capitalization weighting. Under the Defensive risk tolerance philosophy, Total Public Equity is reduced significantly, with much of that coming from the emerging markets equity segment, as one might expect. The allocation to Public Fixed Income rises, with an allowance for Emerging Markets Fixed Income. Under all proposed risk tolerance philosophies, Real Estate receives a 1% increase in its allocation.

117. Panel B indicates that if the UNJSPF elects to consider the new set of discrete asset classes using the constraints outlined in Chapter V, then three of the four discrete asset classes warrant an allocation of at least three percent of total assets. At current levels, this proportion equates to at least $1 billion of new commitments to each of these asset classes.[12] The one new asset class that receives only modest recognition is Emerging Markets Fixed Income, which receives only a 2% allocation under the Defensive risk tolerance philosophy. Conceptually, the risk-adjusted diversification benefits of moving into the Real Return and Private Equity asset classes appear to outweigh the benefits of moving into Emerging Markets Fixed Income, unless the UNJSPF takes a defensive view toward bearing investment risk.

Tests of Added Value Attributable to the New Asset Classes

118. Potentially investing in several new asset classes will very likely be highly resource intensive, requiring efforts to develop new investment policies and procedures, establish new risk management frameworks, and retain new personnel, among other activities. As a result of this amount of contemplated change, the UNJSPF should have an awareness of the potential impact on future Plan condition such efforts might produce. By comparing the impacts on certain Plan financial variables utilizing (i) the suggested policy using current classes versus (ii) the analogous risk tolerance policy using the additional asset classes, we can gauge the potential value that moving to expanded asset allocation might produce.[13]

Comparison of Prudent Funding Policies

119. The optimal asset allocation policies derived under this risk tolerance philosophy are as follows:

Figure 18 – Optimal Policies, "Prudent Funding" Risk Tolerance Philosophy, Unhedged

	Optimal Asset Allocation - %										
Policy Structure	Global Equity	EM Equity	Total Public Equity	Global Fixed	EM Fixed	Total Public Fixed	Real Estate	Priv Equity	Real Return	Short Term	Total
Current Classes	57	7	**64**	26	0	**26**	7	0	0	3	**100**
All Asset Classes	51	7	**58**	26	0	**26**	7	3	3	3	**100**
Difference	-6	0	-6	0	0	0	0	3	3	0	0
Reference: Current Policy	55	5	**60**	31	0	**31**	6	0	0	3	**100**

[12] If the constraints were wider, each of these asset classes may have received more of an allocation. However, several of these asset classes pose significant implementation challenges at the early stages of program development (see Annex II). PCA/EFI and the Steering Committee that the $1 billion level is more than adequate to establish and manage a new investment program over the next investment cycle.

[13] This section reviews numerous simulations of UN Plan financial performance under the proposed policies. Mean-variance return and risk statistics of the proposed policies appear in Annex V.

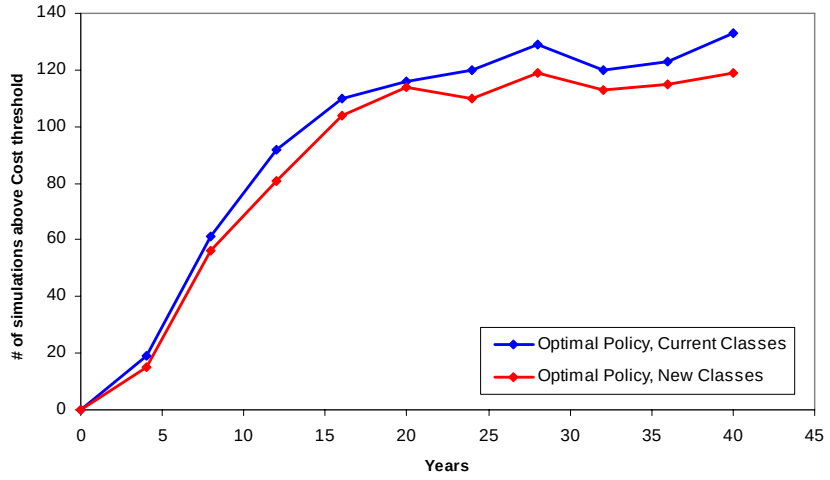
120. Under this risk tolerance philosophy, fixed income assets decline versus current policy regardless of the selected policy structure. If all asset classes are utilized, then allocations to the Private Equity and Real Return asset classes are substituted for a commensurate reduction in the Global Equity asset class.

121. The Prudent Funding risk tolerance philosophy focuses on improving funding over time, while seeking to reduce cost volatility and maintain long-term solvency. Across all of these attributes, the policy including all asset classes exhibits marginal improvement over its current asset class counterpart (see charts below).

Figure 18 – Optimal Policies, "Prudent Funding" Risk Tolerance Philosophy

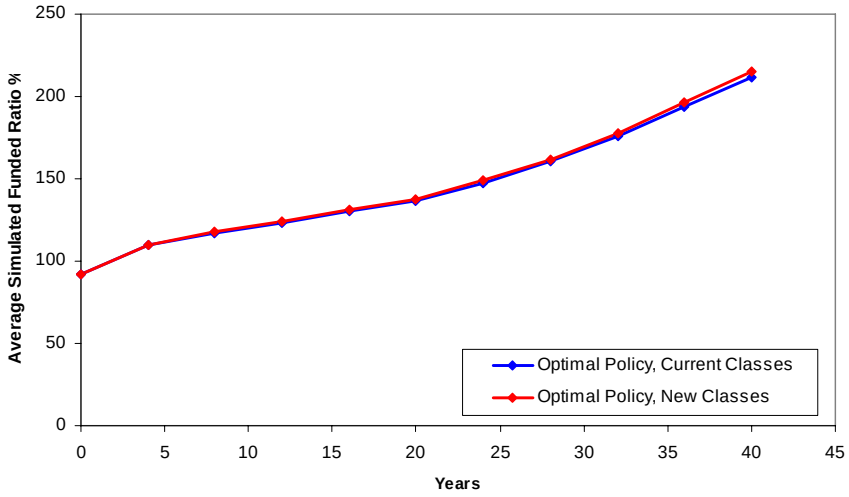
Panel A – Cost Volatility Comparisons

Optimal Policy (Current Classes Only) vs. Optimal Policy (with New Asset Classes)



Panel B – Funding Ratio Comparisons

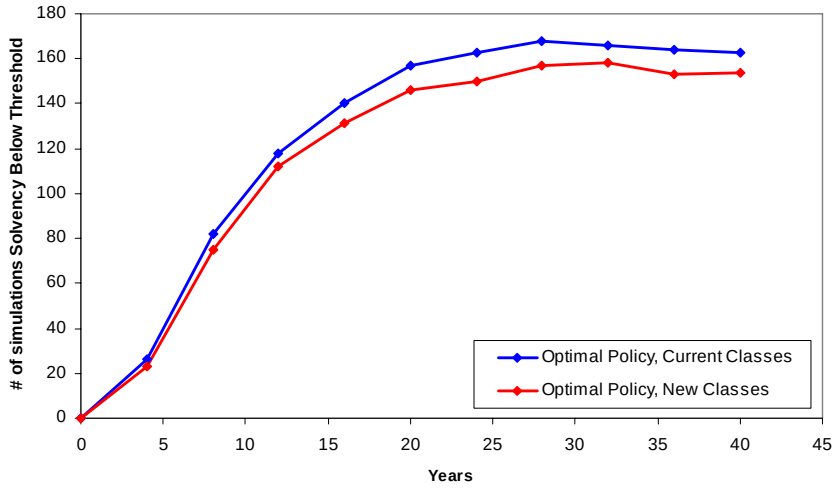
Optimal Policy (Current Classes Only) vs. Optimal Policy (with New Asset Classes)



(see next page)

Panel C – Solvency Comparisons

Optimal Policy (Current Classes Only) vs. Optimal Policy (with New Asset Classes)



122. Based on the charts above, under the Prudent Funding philosophy, extending asset allocation policy to include new asset classes would marginally reduce cost volatility and the potential for insolvency. While positive, the improvement in long-term funding appears to be immaterial.

Comparison of Return-Oriented Policies

123. The optimal asset allocation policies derived under this risk tolerance philosophy are as follows:

Figure 18 – Optimal Policies, "Return-Oriented" Risk Tolerance Philosophy, Unhedged

	Optimal Asset Allocation - %										
Policy Structure	**Global Equity**	**EM Equity**	**Total Public Equity**	**Global Fixed**	**EM Fixed**	**Total Public Fixed**	**Real Estate**	**Priv Equity**	**Real Return**	**Short Term**	**Total**
Current Classes	55	6	**61**	29	0	**29**	7	0	0	3	**100**
All Asset Classes	53	7	**60**	26	0	**26**	5	3	3	3	**100**
Difference	-2	1	-1	-3	0	-3	-2	3	3	0	0
Reference: Current Policy	55	5	**60**	31	0	**31**	6	0	0	3	**100**

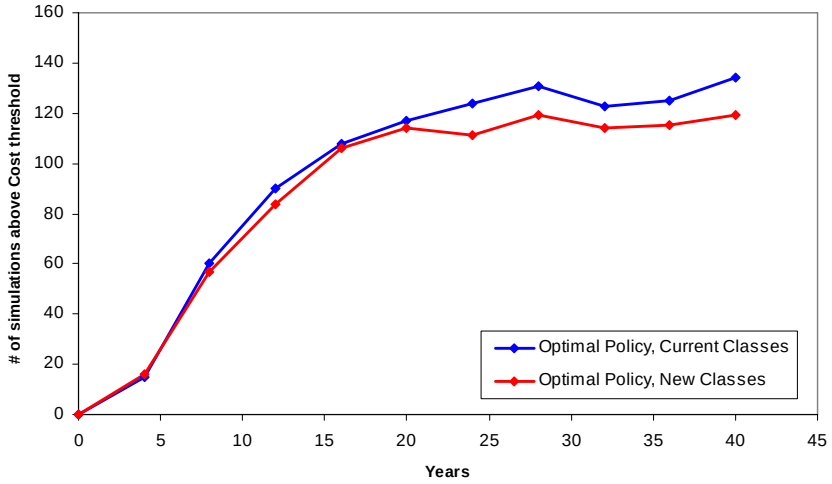
124. Under this risk tolerance philosophy, equity assets remain virtually intact versus current policy, with varying reductions in fixed income policy allocations. If all asset classes are utilized, then allocations to the Private Equity and Real Return asset classes are substituted for commensurate reductions in the Global Fixed Income and Real Estate policy allocations.

125. The Return-Oriented risk tolerance philosophy focuses producing favorable real returns over time. The policy including all asset classes exhibits average annual real return improvement of between 0.2% and 0.3% per year. In addition, this latter policy portfolio exhibited marginal improvement in both projected Plan cost volatility and solvency attributes (see charts, next page).

Figure 19 – Optimal Policies, "Real Return" Risk Tolerance Philosophy

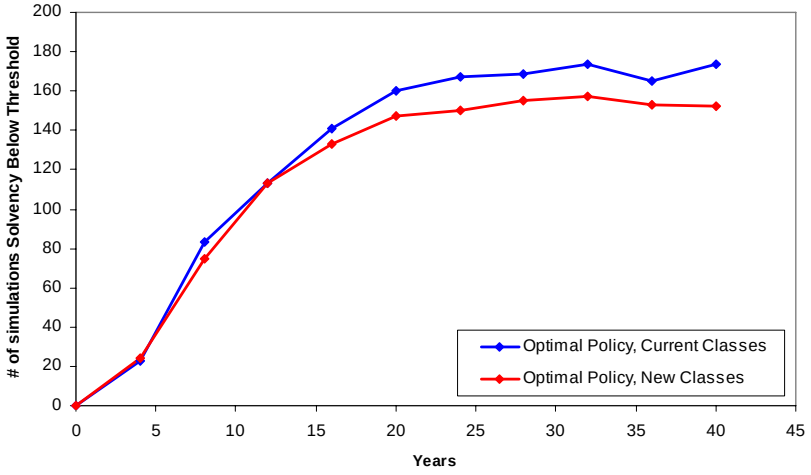
Panel A – Cost Volatility Comparisons

Optimal Policy (Current Classes Only) vs. Optimal Policy (with New Asset Classes)



Panel B – Solvency Comparisons

Optimal Policy (Current Classes Only) vs. Optimal Policy (with New Asset Classes)



126. Based on the charts above, under the Return Oriented philosophy, extending asset allocation policy to include new asset classes would marginally reduce cost volatility and the potential for insolvency.

Comparison of Defensive Policies

127. The optimal asset allocation policies derived under this risk tolerance philosophy are as follows:

Figure 20 – Optimal Policies, "Defensive" Risk Tolerance Philosophy, Unhedged

	Optimal Asset Allocation - %										
Policy Structure	Global Equity	EM Equity	Total Public Equity	Global Fixed	EM Fixed	Total Public Fixed	Real Estate	Priv Equity	Real Return	Short Term	Total
Current Classes	54	3	**57**	32	1	**33**	7	0	0	3	**100**
All Asset Classes	47	3	**50**	32	2	**34**	7	3	3	3	**100**
Difference	-7	0	-7	0	1	1	0	3	3	0	0
Reference: Current Policy	55	5	**60**	31	0	**31**	6	0	0	3	**100**

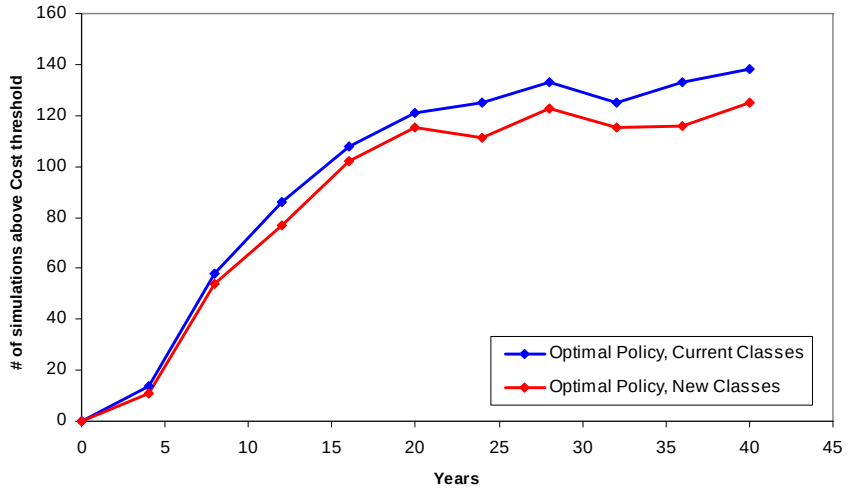
128. Under this risk tolerance philosophy, equity assets would decline by varying material amounts, with offsetting increases in fixed income and real estate policy allocations. In both instances, allocations to Emerging Markets Fixed Income arise. If all asset classes are utilized, then allocations to the Private Equity and Real Return asset classes are substituted for commensurate reductions in the public equity asset classes. Note that Emerging Markets Equity is now underweighted versus a market-weighted policy benchmark.

129. The Defensive risk tolerance philosophy focuses on reducing cost volatility, reducing the likelihood of funding deterioration, and protection against insolvency. The all-inclusive asset allocation policy portfolio exhibited marginal improvement across the protection-oriented attributes (see charts below and next page).

Figure 21 – Optimal Policies, "Defensive" Risk Tolerance Philosophy

Panel A – Cost Volatility Comparisons

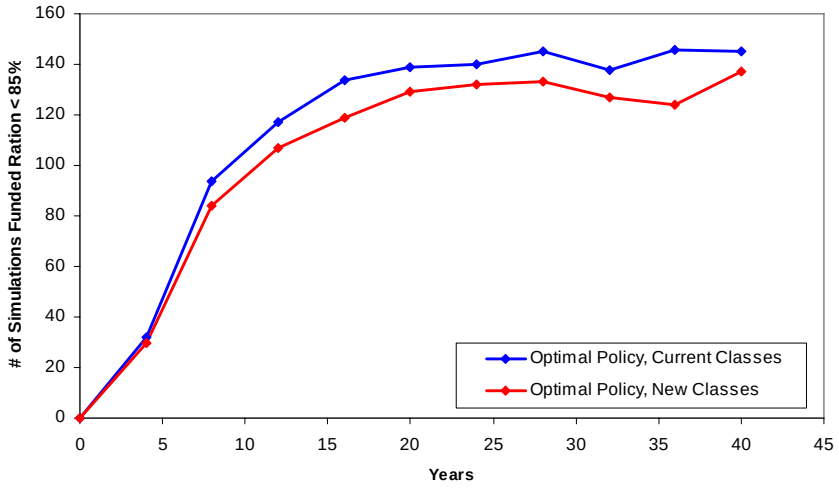
Optimal Policy (Current Classes Only) vs. Optimal Policy (with New Asset Classes)



(see next page)

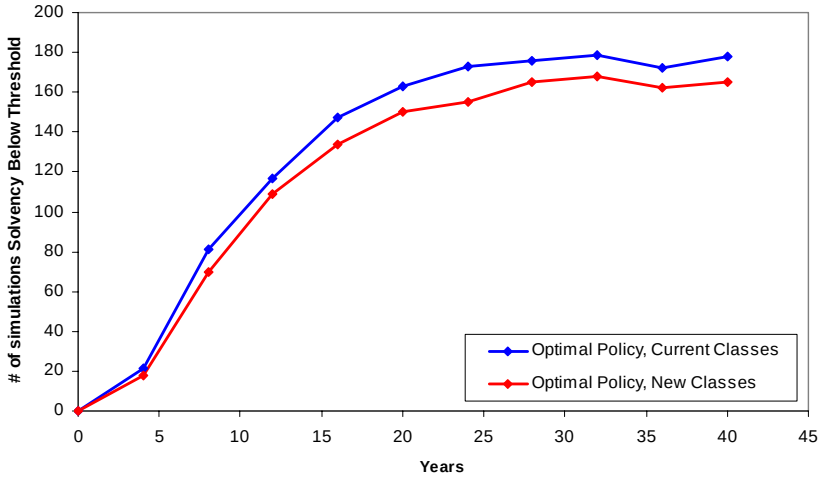
Panel B – Funded Ratio Deterioration Comparisons

Optimal Policy (Current Classes Only) vs. Optimal Policy (with New Asset Classes)



Panel C – Solvency Comparisons

Optimal Policy (Current Classes Only) vs. Optimal Policy (with New Asset Classes)



130. Based on the charts above, under the Defensive philosophy, extending asset allocation policy to include new asset classes would marginally reduce cost volatility, better protect against funded ratio deterioration and reduce the potential for insolvency.

131. In summary, regardless of the risk tolerance philosophy chosen, the inclusion of new asset classes brings marginal expected improvements to the UNJSPF Plan's simulated financial performance. Given these results, PCA/EFI recommends that the UNJSPF consider adopting an asset allocation policy that expands the asset allocation opportunity set to include Private Equity, Real Return assets, and if a Defensive risk tolerance position is taken, Emerging Markets Fixed Income.

Analysis of the Impact of Currency Hedging

132. Currency hedging had virtually no impact on asset allocation results. In fact, optimized asset allocations with hedging marginally underperformed optimized asset allocations without hedging more often than they outperformed (see Annex IV). This result indicates that, regardless of the risk tolerance selected, hedging currency risk out of the underlying asset classes was not a worthwhile exercise.

133. These results indicate that it is highly unlikely that a strategic passive currency hedging strategy would materially improve the risk-adjusted financial performance of the overall UNJSPF Plan. Therefore, it is the view of PCA/EFI and the ALM Steering Committee that passive currency hedging strategy should not be undertaken.

134. Given the multi-currency structure of UNJSPF benefits and liabilities, the rationale for establishing a hedging strategy for the liabilities foreign exchange component would be to establish a known cost level in U.S. dollars (which is the base currency for the Fund's contributions, pensionable remuneration, actuarial valuations and for assessing the Plan's solvency), and to ensure that the Fund has adequate resources over time to meet its pension promise under most economic environments and foreign exchange scenarios. However, as mentioned earlier there are several variables that affect the foreign exchange component of the liabilities (e.g. the utilization rate of the two track feature; the behavior of the exchange rates of different currencies versus the U.S. dollar over the long term; the volatility in the U.S. equivalence of General Service staff contributions; etc.) that make the foreign exchange exposure vary over time and which make its assessment quite difficult. Nevertheless, the Model allows for some random simulation of the economic variables which affect the Plan's costs and solvency ratios. These are measured and captured in the risk framework (risk philosophies) and the underlying rationale for hedging (reducing the volatility of the cost and ensuring adequate resources to meet commitments) is indirectly addressed in the test performed for each optimum asset allocation under each risk philosophy, reaching the same conclusion expressed in the preceding paragraph that adopting a currency hedging mechanism is not warranted.

Conclusions

135. This initial asset-liability study is expected to help establish a long-term strategic asset allocation target for the UNJSPF and will serve as the foundation for future asset-liability reviews for UNJSPF. The UNSG and the UNJSPF and its governing bodies should consider this study as the beginning of an evolving and ongoing process to (i) select and enhance the strategic asset allocation for UNJSPF and (ii) assess the impact of key investment and solvency-related decisions upon the financial condition and performance of the of the UNJSPF. While certain strategic investment decisions may arise from this study, UNJSPF decision makers should continue to develop processes that revisit and update key strategic considerations emanating from this project.

136. This process should be implemented at two distinct levels. At management's level, the ALM Steering Committee should continue to meet to analyze important solvency and asset allocation issues, to perform *ad hoc* and "what-if" analysis as well as to collect and review ALM assumptions including data relative to financial markets. Considering the

sui generis governance structure of the UNJSPF, the ALM Steering Committee would provide the required integral view and coherent forum to analyze and submit the relevant recommendations to the consideration of the UNSG and to the Pension Board. At the level of its governing bodies, the UNJSPF should consider the convenience of periodically reviewing ALM related issues. Therefore, we recommend that the asset-liability study should be updated at least following each actuarial valuation (every two years) with the potential for annual reviews to assess evolving changes in the Plan's financial condition, as well as consider new investment approaches and/or areas of investment.

137. The determination of an asset allocation policy is extremely important as it will be, by far, the most important element of investment decisions, significantly impacting the long-term risk-adjusted performance of the UNJSPF. Other decisions, such as considering certain tactical exposures, the use of external investment managers, the use of active or passive management, and other decisions, while critical, were not within the scope of this study. The asset allocation policy decision, however, provides an important framework to the UNSG to begin considering the practical implementation aspects associated with converting long-term policy intentions into actual investment results.

138. The guidance received from the Investments Committee and the Committee of Actuaries will assist the UNSG to develop a comprehensive investments policy and submit it for the consultations and approval of its governing bodies as appropriate.

139. As might be expected, in the simulations of UNJSPF financial condition, we found that there is a fairly wide range of potential outcomes. However, we also found that the UNJSPF is stable and well-funded and is expected to realize additional actuarial gains due to favorable recent investment performance. Over the foreseeable future, the funded status of the UNJSPF should remain favorable, with long-term projections of its funding ratio (termination basis, with COLA) approximating the 100% level.

140. The results of the study also indicate that it is highly unlikely that a strategic passive currency hedging strategy would materially improve the risk-adjusted financial performance of the overall UNJSPF Plan.

141. The key discussion for the Investments Committee and the Committee of Actuaries will be to select the an appropriate risk tolerance philosophy that best represents their views to make recommendations to the UNJSPF about how to manage plan financial risk over the next several years and to recommend the strategic asset allocation of the UNJSPF to the UNSG, considering the respective ideal/optimal mix recommended by this study.

142. The analysis in this study indicates that addition of new asset classes provides marginal long-term benefits to the Fund, regardless of the level of risk tolerance. Therefore, PCA/EFI recommends that the UNJSPF consider the policies in Panel B, above, that allow for the inclusion of new classes.

143. If new asset classes are to be added to the strategic asset allocation target of the UNJSPF, the corresponding implementation may occur over an extended period of time. The joint committee of the Investments Committee and the Committee of Actuaries need

to agree on their recommendations for the UNSG to add new asset classes. If the Pension Board adopts these recommendations, the UNSG will likely need to take into account the resource and procedural adjustments required by UNJSPF to invest in these asset classes.

Chapter VIII
Annexes

I. **Background on Expected Return and Risk Assumptions**

II. **Asset Class Benchmarking and Implementation Issues**

III. **PCA/EFI Asset Class Resampling Data Set Used in UNJSPF Study**

IV. **Tests of Currency Hedging**

V. **Mean-Variance Statistics, Various Recommended Policies**

VI. **Glossary of Terms**

ANNEX I

Pension Consulting Alliance/EFI Actuaries

Background on
Expected Return and Risk Assumptions

January 2007

ANNEX I

Contents

Chapter I

Introduction

1. In late 2006, the United Nations Joint Staff Pension Fund ("UNJSPF" or "Plan") retained Pension Consulting Alliance, Inc. and EFI Actuaries, Inc. ("PCA/EFI") to conduct an asset-liability study. An asset-liability study is an important tool utilized by decision-making bodies overseeing pension plan sponsor assets to determine a long-term, strategic investment asset allocation policy for the plan sponsor's assets.

2. In the asset-liability modeling process, two major components of the plan sponsor's overall balance sheet are modeled, projected, and analyzed: plan liabilities and plan assets. Since plan liabilities are actuarially-based, there are a significant number of actuarial variables that are quantified and simulated. Plan assets are modeled by parsing them into categories reflecting the world's major capital market segments. A key tenet underpinning the asset allocation decision-making process is that diversification across major capital market segments (and, therefore, major strategic asset classes) should enhance a portfolio's risk-adjusted returns. As a result, within the modeling process, expectations about the investment returns, risks, and co-movements of and among a spectrum of asset classes are developed. The development of these expectations is the focus of this report.

3. This report is organized in the following manner: First, we review our approach for developing expected average annual returns, risks, and correlations for and among several asset classes. These expectations are consistent with the mean-variance approach to asset allocation optimization that has been relied upon by the investment industry for several decades. In today's investment environment, the mean-variance approach is being critically examined by a wide spectrum of leading investment practitioners. One conclusion is that, since the mean-variance approach is a single-horizon model, it is limited in its applicability to measuring risk *within* an investment horizon. Such within-horizon risk analysis is critical for plan sponsors requiring an assessment of how asset allocation might potentially impact the evolving funding risks of the overall plan. Because of this limitation, simulation-based asset-liability modeling approaches (such as PCA/EFI's) are fast becoming an industry standard. In spite of these issues, assumptions about asset class investment behavior are still required and the mean-variance framework allows practitioners and users a familiar tool for establishing such assumptions.

4. Second, we discuss how mean-variance assumptions are incorporated into the EFI simulation process. Importantly, mean-variance assumptions are viewed as reference points that are then utilized to adjust an historical sample of real asset class investment returns used within the simulation process. While the PCA/EFI modeling approach is flexible in its approach to utilizing mean-variance assumptions, its indirect use of these assumptions overcomes many of the weaknesses associated with using a strict mean-variance approach to portfolio selection.

Chapter II

Process for Developing Expected Returns, Risks, and Correlations

5. PCA/EFI's approach for developing mean-variance expectations of returns, risks, and correlations combines the use of both asset class history as well as certain asset class fundamentals. Before reviewing our approach to developing expectations, it is important to recognize that our objective is to establish expectations for asset classes that reflect a general *consensus view* of how such assets and their markets are expected to perform in the future. PCA/EFI is not in the business of developing shorter-term asset class expectations (less than 5 years) that might be used for tactical purposes. In addition, it is widely recognized that the entire expectation-setting exercise is highly subjective and may contain significant forecast error. That being said, PCA/EFI reviews a broad range of economic, fundamental, and investment industry data when examining and adjusting its forward-looking mean-variance assumptions.

6. Different procedures are utilized to develop expectations for real returns, risks, and correlations. PCA/EFI's approach to developing asset class return expectations is to utilize the well-known "building block" approach (see discussion below). This approach combines utilizing both fundamental and historical information and data. Developing expectations for risks and correlations relies more heavily on an analysis of historical data. However, PCA/EFI closely examines the trends of these latter measures across asset classes. In addition, given the volatility of the trends, PCA/EFI may use statistical procedures to emphasize more recent data rather than utilize simple computational techniques that treat all asset class history as equivalent in its influence of the future.

A. Developing Expected Returns – The Building Block Approach

7. There are three general building blocks used to construct expected asset class returns: (i) an expected long-term rate of inflation, (ii) an expected return above inflation that compensates an investor for making short-term risk free investments (i.e., the "real risk free rate"), and (iii) expected return premiums for each asset class/market, depending on the amount and type of risk the typical investor is expected to bear when investing in such an asset class/market (i.e., the "risk premium"). As one might expect, the largest portion of most asset classes' returns comes from their respective risk premiums. Not surprisingly, the risk premiums are the most difficult to forecast.

Developing expectations for the long-term rate of inflation

8. PCA/EFI uses both market-based fundamentals and other sources to determine an expected long-term rate of inflation. Market-based information includes differences in yield levels between the 10-year U.S. Treasury Note and the analogous 10-year Treasury Inflation Protected Security (or TIPS) Note. Since the 10-year TIPS Note yield is a real yield (because the par value of the bond is reset based on the CPI-US), the difference between the 10-year U.S. Treasury Note yield and the 10-year TIPS yield represents a market-based consensus view on inflation over the next 10-year horizon. As of 12/26/2006, the current yield on the 10-year U.S. T-Note was 4.60% while the current yield on the 10-years TIPS Note was 2.34%. The difference (4.60% - 2.34%), 2.26%, represents an initial baseline assumption for inflation.[14] While this point estimate appears

[14] Breakeven inflation using the comparable 30-year Notes was 4.73% - 2.24% = 2.49%.

reasonable, several practitioners have argued that TIPS are currently trading at relatively high yields (i.e., "cheap") relative to their historical levels (see graph below).

Figure 1 – Implied Inflation Rates, Using 10-Years TIPS

Source: Brown Brothers Harriman, Bloomberg, JP Morgan.

9. Based on the graph above, recent breakeven inflation rates derived from the two Notes above have ranged from 2.25% to 2.75%. Typically, once the 2.25% level has been breached, TIPS have appreciated, causing the breakeven inflation rate to rise. As the chart above highlights, market-based inflation expectations have hovered around 2.5%.

10. Several short-to-intermediate factors can impact breakeven inflation rates. Such factors include (i) the carry trade expectations (i.e., selling short TIPS and buying long TIPS) and (ii) price volatility that is associated with headline inflation, but not the core CPI-U inflation (e.g., fluctuations in oil prices). For example, carry trade expectations have reduced breakeven inflation rates by historically high amounts recently because of declining inflation, low market volatility, and inactivity on the part of the Fed (see chart below).

Figure 2 – Trend of Carry Impact on 10-Year TIPS Breakeven Inflation

Source: JPMorgan

11. Also, during the second half of 2006, headline inflation was actually declining rapidly as oil prices began their downward adjustments. When headline inflation

declines more rapidly than core inflation, breakeven inflation rates tend to understate longer-term expectations for inflation.

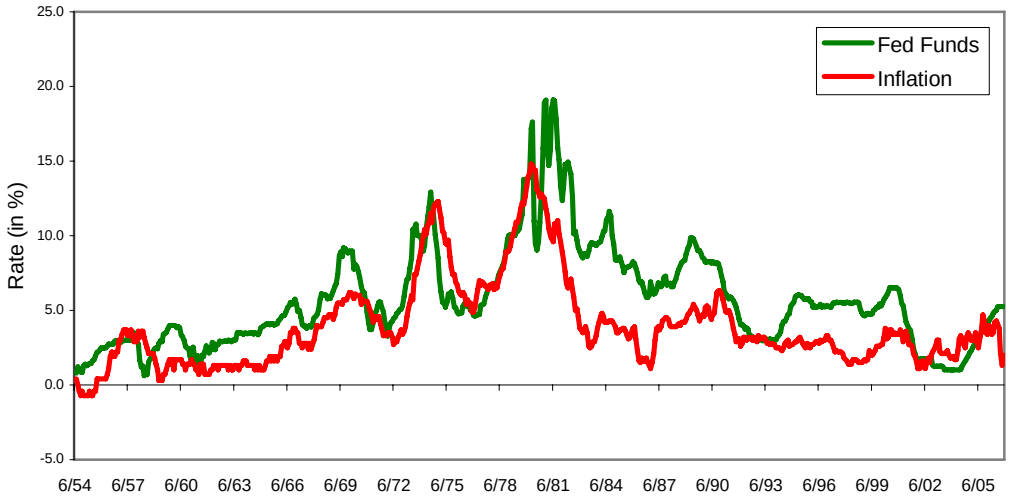
12. Given that market expectations for inflation provide a reasonable, but potentially volatile assessment, PCA/EFI also typically refers to other credible sources within the marketplace to gain a broader consensus view of inflation. Several of these sources include leading investment management firms and/or investment banks.[15] However, PCA/EFI also considers other well-regarded sources (such as the International Monetary Fund[16]). The consensus view of all these sources is that global inflation is very likely to remain within a 2%-3% band, with 2.5% being the long-term level of choice. Therefore, in developing its forward-looking return expectations for 2007, PCA/EFI selected 2.5% as its level for the inflation "block" of its return expectations.[17]

Developing expectations for the real risk-free return

13. The real risk-free rate can take two forms: (i) a short-term rate of return based on default-free government debt and (ii) a rate of return or yield on a default-free zero-coupon bond whose duration closely matches the horizon of an investor's cash flow requirements. PCA/EFI examines the returns of 90-day Treasury Bills to address (i) and examines the yields on 10-year TIPS to address (ii).

14. Developing expectations for the short-term real risk-free return requires an examination of its history, as well as a subjective assessment of the trend associated with the Fed's inclination to raise or lower its lending rates for the foreseeable future. Over recent history, linkage between inflation and Fed action has been loose at best (see chart below).

Figure 3 – History of Fed Funds and Inflation



Source: Federal Reserve, NBER, PCA

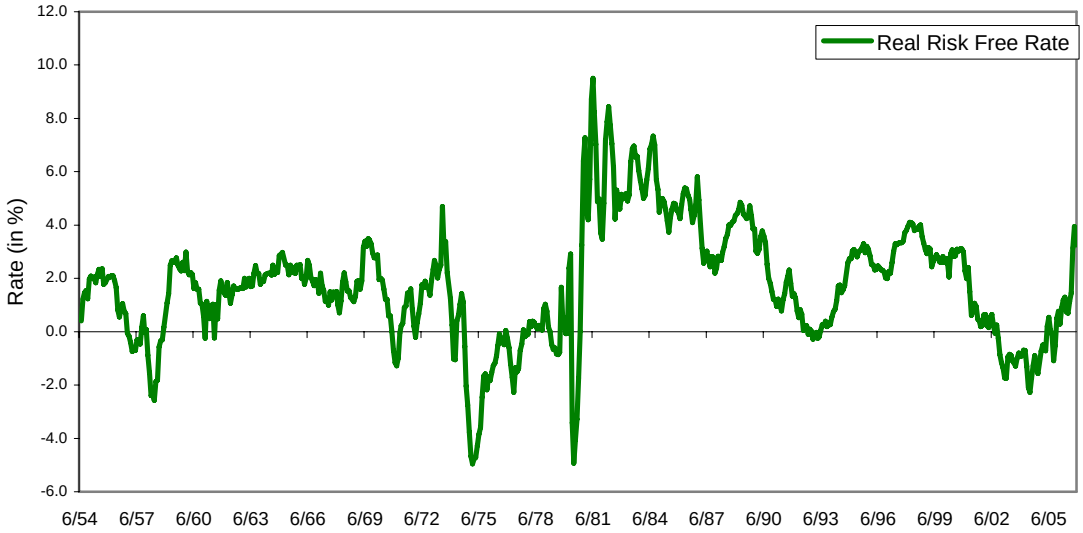
15 See, for example, "JPMorgan Asset Management long-term capital market assumptions," JPMorgan, November 2006; "Developing Capital Market Expectations," Wellington Management, February 2006.

16 See, for example, "Possible Cyclical Challenges Facing Financial Markets," Chapter 1, pp. 8-9.

17 Inflation estimates are used primarily to determine expected nominal rates of return. Within the UNJSPF asset-liability model, expected real rates of return for the various asset classes are combined with the UNJSPF's expected 4.0% annual inflation rate.

15. As indicated in the chart above, since the early 1990's, core inflation in the U.S. has proven relatively benign, while short-term rates (as measured by the Fed Funds rate) have exhibited a wide range. As a result, the real risk-free rate (Fed funds minus inflation) has been quite volatile (see chart, next page).

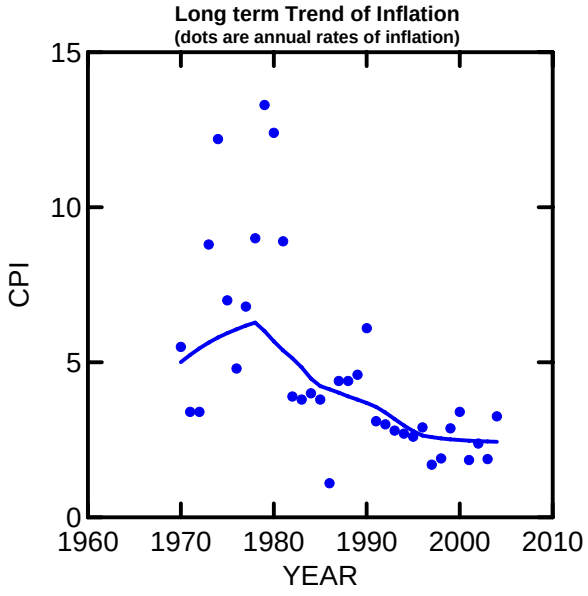
Figure 4 – History of Real Risk-Free Rate



Source: Federal Reserve, NBER, PCA

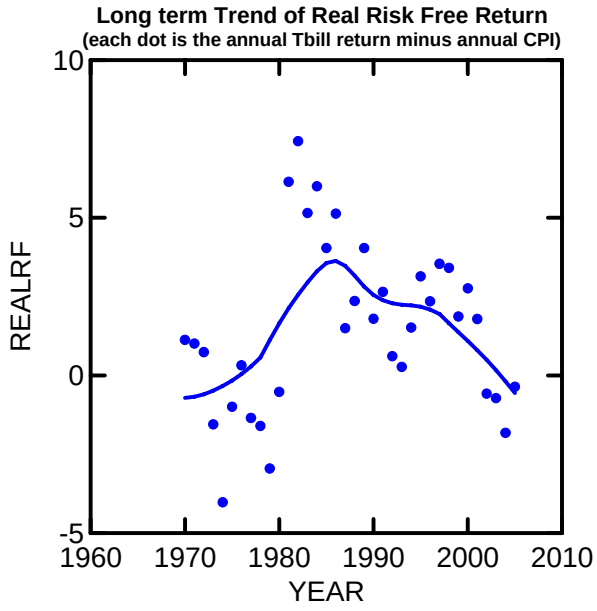
16. To further develop intuition about inflation and the real risk-free rate, we have examined the trends of their annual time series utilizing exponential smoothing techniques. Interestingly, both series have exhibited declining trends over recent history with no dramatic outliers (see charts below and on the next page).

Figure 5 – Trend of Inflation



Source: PCA/EFI

Figure 6 – Trend of the Real Risk Free Return



Source: PCA/EFI

17. Given the relative stability of inflation, and the willingness of the Fed to not only raise rates to control inflation, but to cut rates aggressively in order to spur economic growth, it is unlikely that the real risk-free return would exceed 2.5% for an extended period without some significant exogenous signal. Given the Fed funds rate's currently relatively high level (in the context of recent history), we believe the tendency will be for the Fed to ease, rather than tighten, interest rates over the next investment cycle.[18] Beyond that, it is difficult to determine the direction of the real risk-free return. Given the above factors and trends, PCA/EFI believes an appropriate short-term real risk-free return expectation is in the range of 1.50% to 1.75%. This level is higher than the long-term average for the real risk-free return, but lower than the current real Fed funds lending rate. Of course, the expected real risk-free return could vary significantly from this level if an investor collected his/her returns in a currency other than the U.S. Dollar.

18. To determine a longer-term real risk-free rate, we examine the yield of the 10-year TIPS Note. As discussed earlier, the TIPS' real yield was 2.34% as of 12/26/2006. Given expectations that U.S. economic growth is expected to stabilize in the range of 2.0% to 2.5% for the next business cycle,[19] this may prove marginally beneficial to TIPS returns. As a result, we expect the longer-term real risk-free return to be close to 2.5% over the next investment horizon. This level is consistent with the estimates from other practitioners.[20]

[18] See, for example, Goldman Sachs Forecast, December, 18, 2006: "Fed to Cut to 4.5%..."

[19] See, for example, "US Economic and Investment Perspectives," AllianceBernstein, December 8, 2006.

[20] Op cit, "JPMorgan Asset Management long-term capital market assumptions;" also, "Global Perspectives, December 2006," UBS Asset Management.

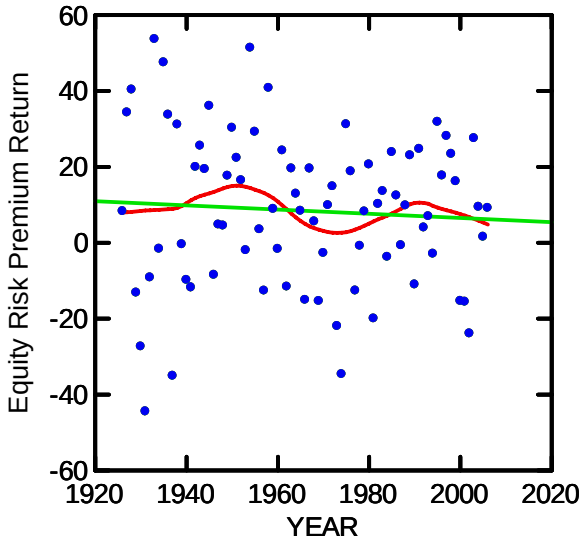
Developing expectations for the U.S. Equity risk premium

19. As highlighted earlier, that portion of an asset class's return associated with various risks above and beyond the risk-free return is often the largest component, the most volatile, and the most difficult to forecast. With these caveats in mind, PCA/EFI begins its analysis by examining the trends of various risk premium returns over time, not merely their averages. The behaviors of these trends provide two important signals about risk premium returns: (i) whether there is any indication of cyclicality and (ii) whether long-term trends exhibit stability. From a long-term strategic perspective, outlying single-year returns and market events may prove to have only modest influence on long-term trends. Once such trends are confirmed, PCA/EFI extrapolates the trend to arrive at an initial estimate of an asset class's projected risk premium return. Confidence in this trend estimate is also a function of asset class return history. The shorter the return history for a specific asset class, the less reliable the trend. For asset classes with less than 10-years of history, more qualitative approaches are used to develop risk premium estimates.

20. With initial estimates of the risk premium returns in hand, we will verify those estimates with those of a spectrum of practitioners, including investment advisors and other investment consultant organizations. In addition, we examine specific estimates with risk premiums determined through the use of fundamental models and asset class betas in relation to a global investable capital market portfolio.[21] To the extent that our estimates deviate significantly from these other sources, we will make appropriate adjustments. Again, our effort here is to develop a set of reasonable consensus-based expectations.

21. As an example, the trend of the U.S. Equity risk premium return appears below.

Figure 7 – Trend of the U.S. Equity Risk Premium Return, Last 80 Years

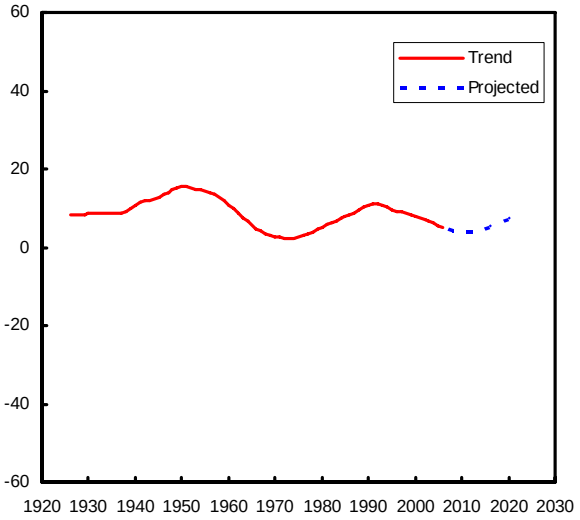


Source: PCA/EFI

[21] As determined largely by UBS' Investable Capital Market allocation estimates, which are updated annually.

22. Figure 7 shows that the trend of the annual U.S. Equity premium has exhibited a cyclical behavior reaching respective peaks and troughs every 20 years or so. In addition, the linear trend line is nearly flat, but moving downward at a very modest slope. Given these trends, we would expect the trend of the U.S. Equity risk premium return to begin adjusting upward within the next several years as it recovers from its downward slide that began from its early 1990's peak (see chart below).

Figure 8 – Extrapolation of Equity Risk Premium Return, Next 15 Years



Source: PCA/EFI

23. Any improvement in the trend line, however, will likely not reach its prior peak, which was supported by the bull markets of the mid-1980's and mid-to-late 1990's. The average level of the projected trend is in the range of an annual 4.5% to 5.0% per year.

24. We next examine how this finding reconciles with other analyses. Our first step is to compute estimates of long-term equity risk premium utilizing the basic dividend discount model:

$$RP_e = D/P + g - R_f \pm [\textit{impact due to valuation changes}]$$

where:

RP_e is the estimated equity risk premium
D/P is the current dividend yield
g is the long-term dividend growth rate, and
R_f is the risk-free rate.

25. The last term is more subjective in nature and reflects more of a potential expected penalty/reward that is a function of where current price-earnings (P/Es) multiples are in relation to their historical averages. If P/Es are relatively high, then one might argue that the equity risk premium will be penalized as it normalizes over time. Conversely, if current P/Es are low, then one might expect the equity risk premium to be higher.

26. To determine the inputs for the above model, we relied on several sources to estimate a rough consensus view of each variable (see table below).

Figure 9 – Dividend Discount Model Inputs & Estimated Equity Risk Premiums

		Earnings Growth		Dividend Growth				
Source	Benchmark	2007	Long-Term (5+ Yrs.)	2007	Long-Term (5+ Yrs.)	Dividend Yield	Current P/E	Historical Median P/E*
Russell Investment Group	Russell 3000	15.7%	12.2%	-	-	1.74%	15.2	
Goldman Sachs	S&P 500	5.0%	6.5%	8.2%	6.5%	1.87%	15.4	18.2
Bernstein Research	S&P 500			9.0%	9.0%	-	15.9	
Averages		10.4%	9.4%	8.6%	7.8%	1.81%	15.5	18.2
Short-term risk free rate (1)		4.0%						
Long-term risk free rate (2)		5.0%						
Equity Risk Premium vs. (1)		**5.6%**						
Equity Risk Premium vs. (2)		**4.6%**						

Notes:
Russell earnings estimates are 5-year IBES medians
Goldman Sachs long-term dividend growth assumed to revert to long-term earnings growth trend
Current P/Es are based on forward 1-year earning estimates
Historical median P/E from Leuthold group, utilizes normalized earnings
Risk-free rate estimates per PCA

Source: Russell, Goldman Sachs, AllianceBernstein, PCA/EFI

27. Russell's data reflects consensus analysts' estimates for the broad equity market. Goldman Sachs and Bernstein Research are two highly regarded investment banks with Goldman having a growth emphasis and Bernstein having a valuation emphasis. Both firms have focused on the S&P 500 as a proxy for U.S. equities. In summary, the consensus view is optimistic for U.S. equities. Given the risk premiums estimated using the dividend discount model, U.S. equities are expected to produce approximately 9.5% each year over the next 5+ years. The market's current valuation (low P/E relative to history) provides additional impetus for this position.

28. Combining previously highlighted trends in the U.S. Equity risk premium return, as well as a fundamental analysis of the current equity risk premium, PCA believes that an expected annual risk premium return over risk-free short-term assets of 5.0% and an annual risk premium return over risk-free longer-term assets of 4.0% is reasonable. As a result, utilizing the building block approach highlighted earlier, PCA projects that the average annual return of U.S. equities will be 9.0% for the next 10-year horizon.

29. Other practitioners have taken similar views as PCA/EFI about the level of the equity risk premium as reflected in their expected total nominal returns for U.S. equities (see table, next page). Four of the six consulting firms highlighted have expected returns within 10 basis points (0.1%) of the 9.0% level. Keep in mind that returns are single-annual-period returns and do not take into account the impact of projected volatility. As a result, there may be further differences when computing expected returns on a compound-return basis.

Figure 10 – Expected Domestic Equity Returns, Various Organizations

Firm	Expected Nominal Avg. U.S. Equity Return
UBS Asset Management	9.2%
JP Morgan Asset Management	8.6%
Wilshire Associates	10.1%
Russell	9.0%
PCA/EFI	*9.0%*
Callan	9.0%
Ennis Knupp Consulting	8.9%
NEPC	8.5%

Source: Various Firms

Developing expectations for the Non-U.S. Equity risk premium

30. For strategic asset allocation purposes, PCA/EFI believes that it is nearly impossible to predict whether one large public equity capital market (multi-trillion $ market with thousands of publicly-held companies) will outperform another over an extended investment horizon. Therefore, the equity risk premium for non-U.S. equities is set to be equivalent to U.S. Equity premium. In addition, regional, capital-size, and growth-value factors are not considered from a strategic asset allocation perspective. Such market segments are typically highly correlated to one another and, from a modeling perspective, may introduce multi co-linearity error issues into the optimization process. From a more practical standpoint, the relative weightings of such underlying segments often reflect more tactical views which should be viewed as being outside the scope of the strategic asset allocation process.

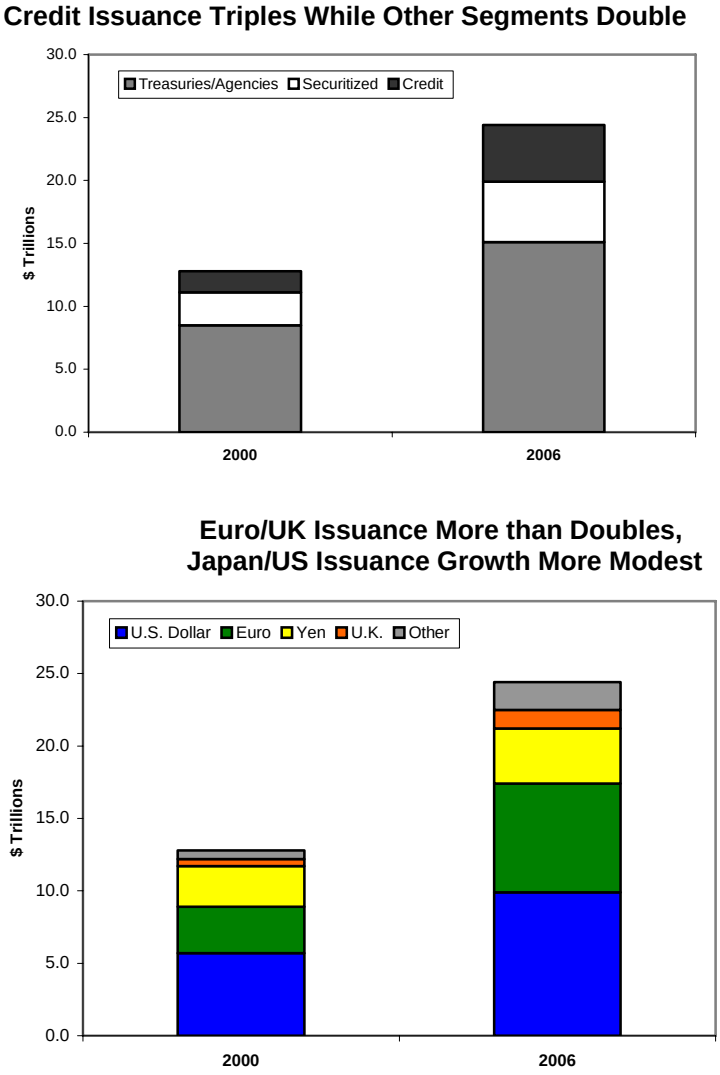
Developing expectations for the Fixed Income risk premium return

31. PCA/EFI applies the same general approach for estimating the expected Fixed Income risk premium return as that applied in establishing equity risk premium returns: (i) examine trends of historical fixed income risk premium trends and (ii) assess market-based fundamentals. Within fixed income, cash flows and cash flow growth are less uncertain than in the equity markets and long-term appreciation of underlying principal does not occur under equilibrium conditions. As a result, current yields-to-maturity across the fixed income spectrum provide key baselines from which to begin projecting long-term returns. From this point, analyses of risk premium trends and the current interest rate environment are then used to adjust the yield-to-maturity to arrive at a final estimate for the Fixed Income risk premium return.

A few words about market structure

32. The global fixed income markets have evolved rapidly over the last several years. This evolution has occurred on three broad fronts: (i) the significant increase in global issuance, (ii) the increasing scale of the global credit markets, and (iii) the growth of Euro-based issues (see charts, next page). What these trends highlight is that the Euro-based fixed income markets are evolving toward a broad structure that is analogous to U.S. Dollar-based structure.

Figure 11 – Global Fixed Income Trends



Source: Lehman Brothers

33. In light of these continuing developments, developing risk premium expectations first for the U.S. bond market and then using those assumptions as a baseline for other fixed income asset classes is a reasonable approach. Similar to developing assumptions for the equity asset classes, PCA/EFI focuses on developing expectations only for the broadest segments of the fixed income markets (U.S., non-U.S., global). For strategic asset allocation purposes, PCA/EFI considers other fixed income categories as components of these broader asset classes. Also, given the rapid convergence of global issuance, PCA believes that long-term global bond risk premiums will be equivalent across the major the regions.

Fixed income risk premium return expectation development procedure

34. As discussed above, PCA/EFI begins its development of the expected long-term fixed income risk premium by examining current yields to maturity of the investment-

grade U.S. fixed income market. As of 12/29/2006, the yield on the Lehman Universal index and its key components were as follows:[22]

Figure 12 – Yields to Maturity – Lehman Universal and its Components

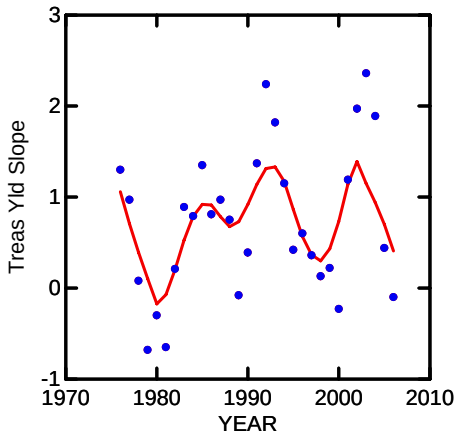
	12/29/2006
Lehman Universal	5.52
Major Segments	
U.S. Treasuries	4.79
Other Govt.-related	5.13
Credits	5.66
Securitized	5.59
Extended Segments	
High Yield	7.70
Eurodollar	5.12
Emerging Market	6.51
144A	5.70

Source: Lehman Brothers, JP Morgan

35. Assuming interest rates remained constant, a core-oriented fixed income portfolio represented by the Lehman Universal offers investors a projected yield of approximately 5.5%. The average maturity of bonds held in the Lehman Universal is 7.2 years making the 5.5% yield a reasonable initial estimate of an expected return from fixed income over an appropriate investment horizon. As of 12/29/2006, the yield on long Treasuries was only 10 basis points higher than the yield on the aggregate Treasury portfolio, indicating that there was little reward for holding longer-maturity debt.

36. Longer-term fixed income returns will be influenced by the future shape in the yield curve as much as the current level of yields. In addition, future credit spreads will also have an impact. To explore these impacts, PCA/EFI examines both (i) the trend in the slope of the Treasury yield curve and (ii) the trend in credit yield spreads utilizing the same statistical procedures used when assessing the long-term trend of the equity risk premium return (see charts below).

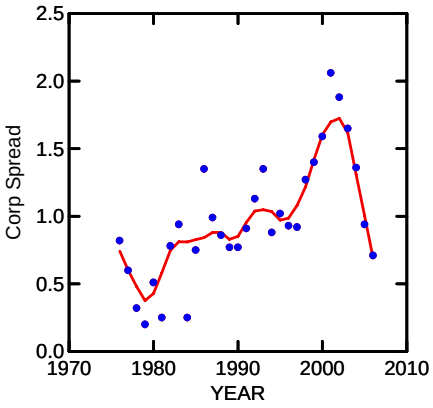
Figure 13 – Trend of Treasury Yield Curve Slope



Source: PCA/EFI

[22] The Lehman Universal index is a benchmark consisting of all U.S. Dollar-denominated bonds globally, subject to certain liquidity constraints.

Figure 14 – Trend of High-Grade Corporate Spreads

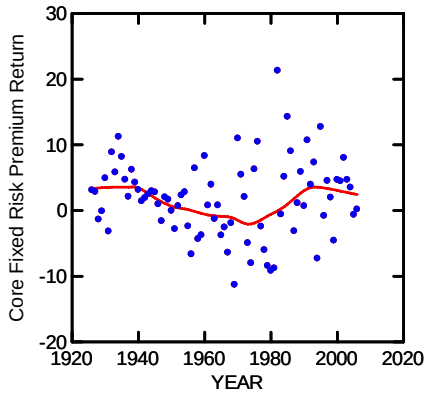


Source: PCA/EFI

37. While the last two years have exhibited flat-to-negative slopes in the yield curve, the long-term average is a yield difference of 75bp to 100bp between 2-year Treasuries and 10-year Treasuries. In contrast, as highlighted in Figure 15, the trend for corporate bond spreads has been increasing although the recently cyclical path has widened dramatically over the last decade. Both of the above trend patterns indicate that investors should be quite wary of assuming current yield and spread levels will remain intact for the foreseeable future. On the contrary, the trends indicate that each of their paths is at its cyclical trough and yields and spreads could very well revert to their long-term trend path. Rising yields and widening spreads impact long-term fixed income returns in two ways: (i) through higher reinvestment rates of current coupon payments and (ii) through lower values due to higher discount rates. In the near-to-intermediate term, factor (ii) would likely dominate, reducing bond returns across all horizons. For this reason, PCA/EFI believes a return penalty of 0.25% (25bp) per year should be incorporated into the expected annual fixed income return. As a result, we believe an adjustment from the previously discussed 5.5% annual return to 5.25% is warranted. Given the expected short-term risk free rate of 4.0%, PCA/EFI estimates the fixed income risk premium return to be 1.25% per year.

38. To verify the above risk premium estimate PCA/EFI again examined the trend of the fixed income risk premium return (see Figure 15, below).

Figure 15 – Trend of Core Fixed Income Risk Premium Return

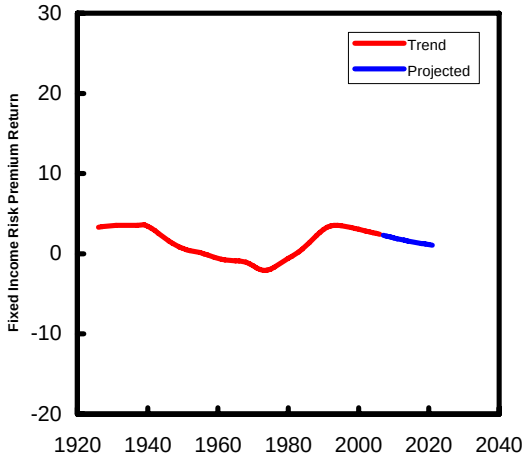


Source: PCA/EFI

39. As Figure 15 highlights, the fixed income risk premium return grew dramatically during the 1980's and 1990's as the overall level of interest rates exhibited a long-standing declining trend. Since the late 1990's both trends have reversed themselves and have been declining.

40. We extrapolated the trend, forecasting the trend out another 15 years (see chart below, blue line).

Figure 16 – Extrapolation of Fixed Income Risk Premium Return, Next 15 Years



Source: PCA/EFI

41. The projection indicates that the trend of the risk premium return continues its decline to around 1.0% per year 15 years from now. We believe this extrapolation of the trend is consistent with the fundamentals cited earlier, relating the fixed income market's current yield-to-maturity to yield curve structure and spread trends. Therefore, it is our view that the fixed income markets will offer a risk premium of 1.25% over the short-term real risk free rate and 0.25% over commensurate maturity U.S. TIPS for the next 10 years or so.

Developing expectations for other major fixed income risk premiums

42. As discussed earlier, PCA typically develops expectations for non-U.S. fixed income and therefore, by default, global fixed income. As we highlighted earlier, PCA/EFI believes the convergence of global fixed income markets is occurring rapidly and that institutional investors will continue to expand mandates to give practitioners broader global-oriented mandates in the future. Given this broad trend, similar-risk fixed income instruments across at least the developed markets should offer equivalent risk-adjusted returns, after taking potential currency fluctuations into account. Therefore, PCA/EFI sets the risk premium return expectations at the same level for all fixed income asset classes, but risks and correlations can still vary significantly depending on whether currency hedging is allowed.

43. Other practitioners have taken roughly similar views as PCA/EFI about the level of the fixed income risk premium as reflected in their expected total nominal returns for the fixed income asset class (see table, next page). PCA/EFI's expectations reside in the middle of a range that has a minimum expected return of 5.0% and a maximum expected

return of 6.4%. As with the expected equity returns, these expectations are single-annual-period returns and do not take into account the impact of projected volatility. As a result, there may be further differences when computing expected returns on a compound-return basis.

Figure 17 – Expected Domestic Fixed Income Returns, Various Organizations

Firm	Expected Nominal Avg. Fixed Income Return
UBS Asset Management	5.6%
JP Morgan Asset Management	5.3%
Russell	6.4%
Ennis Knupp Consulting	5.8%
PCA/EFI	*5.3%*
Wilshire Associates	5.1%
NEPC	5.0%
Callan	5.0%

Source: Various Firms

Developing expectations for other asset class risk premiums

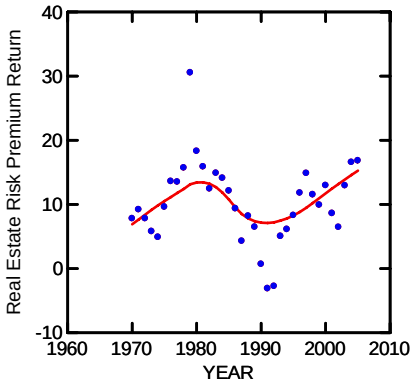
44. With expected risk premium returns developed for the publicly-traded equity and fixed income asset classes, we can now turn to developing expected risk premium returns for the other major asset classes, namely Real Estate and Private Equity.

45. Both these asset classes do not lend themselves well to statistical procedures utilized by the Capital Asset Pricing Model. A key reason for this problem is that these asset classes are not marked-to-market on a near-continuous basis as is the case with the other asset classes. As a result, more reliance on qualitative and subjective procedures is necessary for developing return and risk expectations for these classes.

Real Estate risk premium return expectation development procedure

46. As with the other asset classes, PCA/EFI examines the trends in each of these asset classes' risk premium returns. The trend of the real estate risk premium return has been to exhibit highly cyclical characteristics, largely attributable to the trending behavior associated with real estate appraisals and capital discount rates that fluctuate only modestly over time compared to other market-based rates (see chart below).

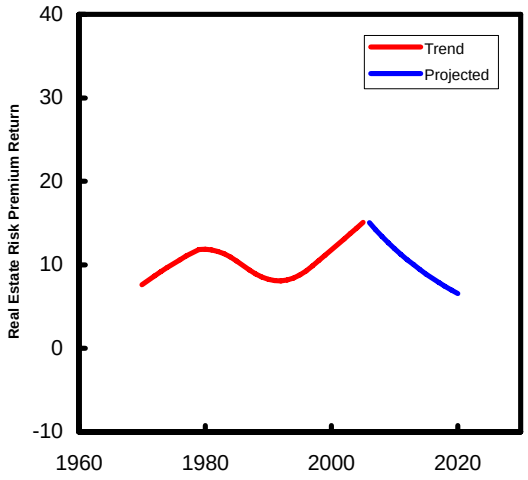
Figure 18 – Trend of Real Estate Risk Premium Return



Source: PCA/EFI

47. Given the rapid cyclical upswing of real estate returns over the last two decades, extrapolating this trend into the future, one would expect the next phase of the risk premium cycle to unfold (see chart below).

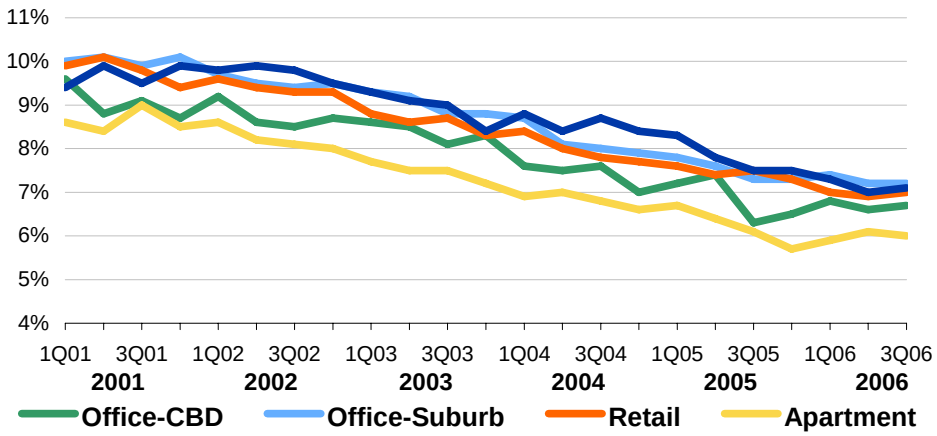
Figure 19 – Extrapolation of Real Estate Risk Premium Return, Next 15 Years



Source: PCA/EFI

48. Such a reversal of real estate's return patterns is consistent with the historically low capitalization rates evident today (see chart below).

Figure 20 – Capitalization Rate Trends – Various



49. For the core real estate asset class (which is typically assumed to be included as an asset class within a strategic asset allocation study), PCA/EFI models its risk premium return as falling between the risk return premiums of stocks and bonds. This approach reflects the common acceptance that real estate is a hybrid asset class offering both potentially high levels of current income (greater than fixed income), while also providing for potential long-term capital appreciation. One other attractive aspect of real estate is that since leases on commercial real estate are typically re-negotiated over time, lease cash flows should grow along with inflation. Thus, the analyses above suggest to

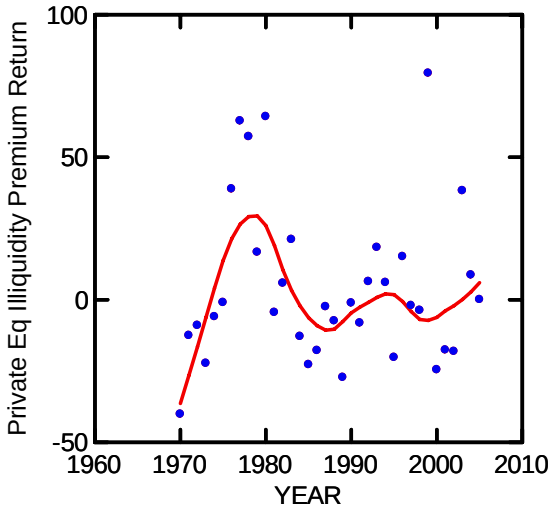
PCA/EFI whether the future expected return of real estate should be above or below the midpoint between the equity and fixed income risk return premiums. Given the above trends and findings with respect to real estate cap rates, PCA/EFI believes the expected risk premium return for real estate should fall modestly below this midpoint. Given that publicly-traded equities are expected to produce an annual risk premium return of 5.0% and that fixed income is expected to generate an annual risk premium return of 1.25%, PCA/EFI believes an appropriate annual risk premium for real estate is 3.0%.

Private Equity risk premium return expectation development procedure

50. Like real estate, private equity is an appraised asset class, not amenable to capital asset pricing model-type modeling processes. In addition, investors' sole motivation for entering the private equity asset class is to produce returns significantly above those for public-traded equities. The excess returns expected from private equity typically range from 3.0% to 5.0% annually over public equity counterparts. This premium is often associated with an "illiquidity premium" required by investors. Such premiums are often realized through establishing illiquidity discounts at the time of private purchase.[23]

51. As with the real estate asset class, PCA/EFI begins by assigning a "default position" for the private equity illiquidity premium. PCA/EFI then adjusts this illiquidity premium based on its current trend and any key fundamental factors impacting the asset class. The long-term trend of the private equity illiquidity premium has declined cyclically over the last 30+ years (see chart below).

Figure 21 – Trend of Private Equity Illiquidity Premium



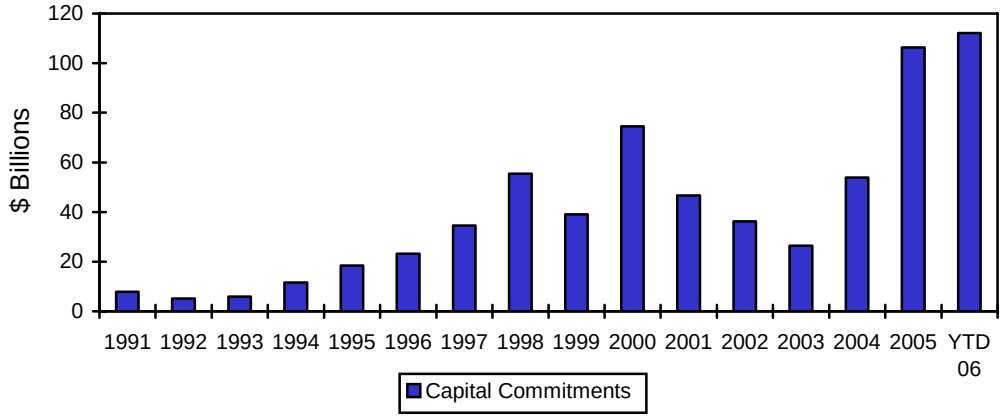
Source: PCA/EFI

52. The figure above indicates that private equity returns have trended upward favorably over the last decade or so, driven largely by results both before and after the equity bear market of the early 2000's. Continued merger and acquisition activity and stable global economic growth indicate that this trend could continue for another investment cycle.

[23] See, for example, Pratt, Shannon, "Discount and Premia," Valuation of Closely Held Companies and Inactively Traded Securities, ICFA, December, 1989.

However, countering these positive underpinnings is substantial capital that continues to flow into this area (see chart, next page).

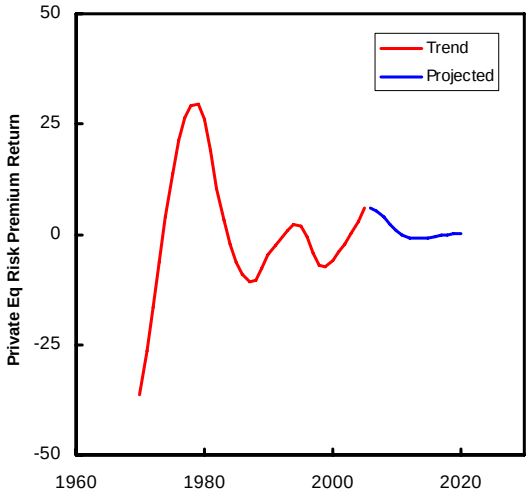
Figure 22 – Capital Flow Trends into Private Equity



Source: Buyouts, various sources

53. Given these market dynamics, PCA generally agrees with the extrapolated statistical trend of the illiquidity risk premium return (see chart below).

Figure 23 – Extrapolation of Private Equity Illiquidity Risk Premium Return, Next 15 Years



Source: PCA/EFI

54. What the figure above suggests is that private equity could continue to produce favorable risk premiums for the next several years, but that, over time, the risk premium could decline materially. Given these findings, PCA/EFI believes an illiquidity premium return of 3.5% (moderately below the 4.0% midpoint discussed above) is an appropriate level. This level suggests a total annual risk premium return for private equity of 8.5%. For both private equity and real estate, it is critical to recognize that realizing such risk premiums could take at least one decade and possibly more. Also, given the higher level of information inefficiency associated with these asset classes, implementation and

manager selection are highly critical factors that will impact an investor's long-term results. In other words, investors cannot hope to capture the risk premium returns associated with these assets through an indexing approach.

55. Other practitioners' expectations for the private asset classes vary around PCA/EFI's (see table below). PCA's expectations for real estate lie toward the middle of a range that has a minimum expected return of 5.8% and a maximum expected return of 7.7%. PCAEFI's expectations for private equity are slightly below the middle of the range that has a minimum of 10.5% and a high of 16.3%. As with the expected equity returns, these expectations are single-annual-period returns and do not take into account the impact of projected volatility. As a result, there may be further differences when computing expected returns on a compound-return basis.

Figure 24 – Expected Private Asset Class Returns, Various Organizations

Firm	Expected Nominal Avg. Real Estate Return	Expected Nominal Avg. Private Equity Return
UBS Asset Management	6.9%	12.0%
JP Morgan Asset Management	7.0%	11.2%
Wilshire Associates	5.8%	16.3%
Ennis Knupp Consulting	7.7%	14.4%
PCA/EFI	*7.0%*	12.5%
Callan	7.6%	12.0%
Russell	6.6%	11.9%
NEPC	6.8%	10.5%

Source: Various Firms

B. Developing Expected Risks and Correlations

56. In PCA/EFI's survey of other practitioners' forecasts, PCA/EFI found that the overwhelming majority simply used historical averages of risk and correlations to arrive at their forward-looking estimates. The argument for not spending significant energy on utilizing more sophisticated approaches to developing expectations for these variables lies in the notion that risks and correlations are more stable than investment returns. As a result, simple averaging of history is an appropriate forecast for the future.

57. While we agree that these attributes are more stable than investment returns, they are not constant variables. Therefore, we believe that automatic defaulting to forecasts that are a simple linear extrapolation of history is inappropriate. At a minimum, for several asset classes and asset class relationships, we believe there are potential long-term trending patterns that should not be taken for granted and, instead, incorporated into the expectation setting process.

58. One challenge is that the investment markets have continued to evolve, allowing new, often broader, asset classes to become accepted. Several such asset classes have limited history, which can leave one guessing how an asset class might perform. In such instances, the average of history (assuming the history sample is reasonable) is *at least* an unbiased estimate of what might occur in the future.

59. Where adequate history exists, however, there is potential to improve upon using the historical average when assessing risks and correlations. This section reviews PCA/EFI's approach to examining the risk and correlation data (The approach used is analogous to our examination of risk premium return trends in prior sections.) As might be expected, for certain asset classes, there is enough evidence of trends and fluctuations in the risk and correlation data to consider making adjustments, rather than merely using historical averages as a proxy for the future.

Developing expectations for asset class risk

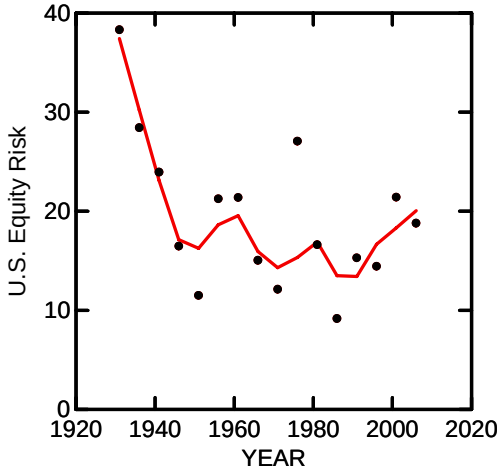
60. To begin analyzing risk patterns among various asset classes, PCA/EFI examines asset class volatility across discrete 5-year holding periods. PCA/EFI believes five years is a minimum horizon required to consider investing in an asset class. In addition, the five-year horizon allows for a minimum amount of observations for a few of the key asset classes (e.g., 80 years of data provides 16 observations). For each five-year period, PCA/EFI computes a standard deviation of returns for each asset class with an appropriate amount of history. Once PCA/EFI has computed a set of five-year data points, we map out the time series of risks to determine patterns and trends in the data. We then use information gathered from this process to adjust the historical standard deviation of an asset class's entire return history. The result is an expectation of an asset class's risk for the next investment horizon.

Examples: Risk of U.S. Equities and Core Fixed Income asset classes

61. To begin our risk projection process, we first review asset class' historical volatilities. For the 81 years ending 2006 (beginning with 1926), the standard deviation of annual returns for U.S. Equity and U.S. Core Fixed Income asset classes were 20.1% and 6.1%, respectively.

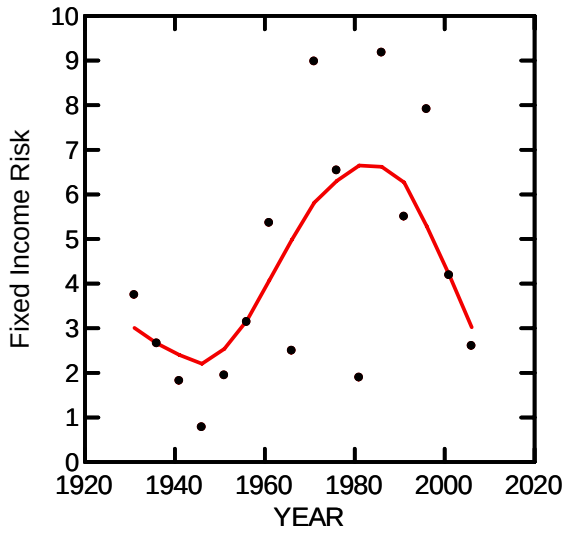
62. We then compute standard deviations for each discrete five-year period ending with 2002-2006. Using statistical procedures, we then map out the trend of those discrete observations. Interestingly, the trends of risk behaviors of the two above asset classes exhibit unique patterns (see Figures below and next page).

Figure 25 – Risk Trend of U.S. Equities



Source: PCA/EFI

Figure 26 – Risk Trend of U.S. Core Fixed Income

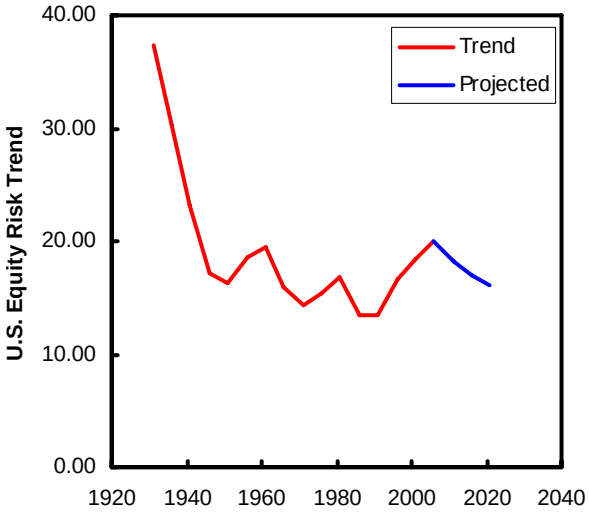


Source: PCA/EFI

63. As the prior charts highlight, historical averages are likely biased by extended periods of dramatic volatility that may not have a direct influence on current forward-looking expectations. For U.S. Equities, such a period was the late-1920's through the 1930's; for U.S. Core Fixed income, such a period was the late-1970's through the mid-1980's. While we believe we should not exclude such data from the analysis, trend analysis at least provides a more appropriate indication of how these periods are, or are not, impacting the current environment.

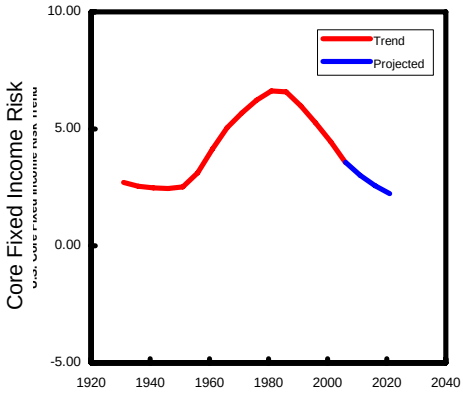
64. PCA then uses autoregressive statistical procedures to extrapolate the trend behavior and additional 2-to-3 five year periods (see Figures below and next page).

Figure 27 – Extrapolation of U.S. Equity Risk Trend



Source: PCA/EFI

Figure 28 – Extrapolation of U.S. Core Fixed Income Risk Trend



Source: PCA/EFI

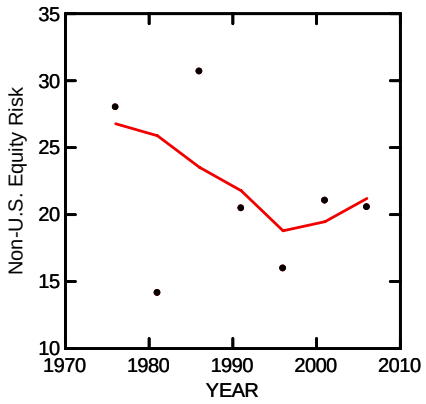
65. As both figures highlight, the trend lines indicate a continuation in the decline of long-term risk for these two major asset classes. Given this indication, PCA/EFI believes that both asset classes' average risks should be revised downward to reflect forward-looking expectations. For U.S. Equities, PCA/EFI believes 15.0% (versus its long-term average of 20.8%) is an appropriate level of risk. For U.S. Core Fixed Income, PCA/EFI believes a risk level of 5.0% (versus its long-term average of 6.1%) is appropriate.

Risk estimates for classes with shorter track records

66. Admittedly, several asset class benchmarks have 35 years or less of history (e.g., international equities, non-U.S. and global bonds, private real estate, and private equity). As a result, the number of 5-year risk data points is too few to perform any meaningful statistical analysis. In these cases, PCA/EFI computes historical standard deviations, weighting the most recent decades heavier than prior decades.[24] Combining these weighted standard deviations with visual inspections of shorter trends provides significant guidance for developing future expectations for asset class risk.

67. For example, PCA/EFI's history of non-U.S. equities begins in 1970, yielding only seven observable 5-year data points (see figure below)

Figure 29 – Risk Trend of Non-U.S. Equity



Source: PCA/EFI

[24] Each decade's history is weighted to have 50% more impact than the prior decade.

68. The historical standard deviation of annual Non-U.S. Equity returns is 22.0%. However, as the figure highlights, high volatility during the late-1970's and again during the mid-1980's is impacting the historical average. Since those earlier periods, risk has trended downward, but more recently appears to be increasing. The decade-weighted annual standard deviation of Non-U.S. equity risk is approximately 17.5%, which is significantly lower than the simple historical average. Given these findings, PCA/EFI determined that an expected risk of 18.5% would be appropriate for Non-U.S. Equities. These procedures are applied to all other asset classes lacking ample history for further statistical trend analysis.

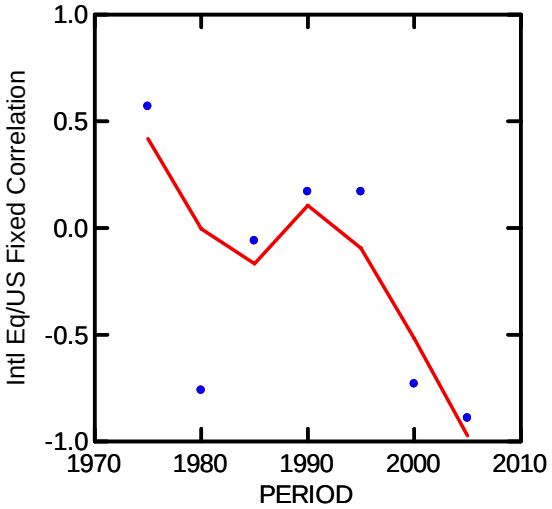
Developing expectations for asset class correlations

69. In developing expected correlations, PCA/EFI applies a process that is equivalent to that used to develop expected asset class risks. Again, most practitioners assume future correlations will be equivalent to their historical averages. This approach is counter to common industry analysis which indicates that correlations can fluctuate significantly over an investment cycle (e.g., the U.S. Equity/Non-U.S. Equity correlation, the U.S. Equity/U.S. Core Fixed Income correlation). Given the potential of fluctuating correlations, PCA again (i) assesses the trends of discrete 5-year correlations, (ii) computes correlations using the decade-weighting scheme described earlier, and (iii) adjusts historical correlations appropriately to account for evident trends and differences versus weighted correlations.

Example: Estimate for the Non-U.S. Equities/U.S. Core Fixed Correlation

70. The historical correlation between Non-U.S. Equities and U.S. Core Fixed Income, based on data going back to 1970, is 0.06 using annual return history. The trend, however, has been for this correlation to move into negative figures over more recent periods (see figure below). In fact, the correlation of annual returns over the last 10 years is -0.70.

Figure 30 – Trend of Non-U.S. Equities/U.S. Core Fixed Correlation



Source: PCA/EFI

71. While PCA does not believe the -0.70 correlation is sustainable, projecting a correlation of 0.06 or higher may also prove misleading. Compounding this issue is the lack of data available for analysis. Weighting the data by more recent periods moves the historical correlation from 0.06 to -0.03, providing further indication that a projected correlation should have a negative sign. Given these findings, PCA believes an estimated correlation in the range of -0.20 to -0.10 is appropriate. Such an estimate implies that returns of Non-U.S. Equities will be largely unrelated to returns of U.S. Core Fixed Income and, if there is any relationship, the returns of these respective asset classes will move in opposite directions. Such expected behavior is consistent with the other return and risk estimates assumed for these respective asset classes.

Chapter III

Using the PCA/EFI Historical Data Set to Model Asset Class Returns

72. The previous chapter reviewed PCA/EFI's process for establishing its mean variance assumptions. As discussed in a prior chapter, the PCA/EFI simulation-based asset liability model utilizes resampling of historical asset class return data to project future portfolio returns. Specifically, we discussed how the levels of the real returns within the PCA/EFI historical dataset are adjusted to match the expected return levels set forth in PCA/EFI's mean variance assumptions.

73. The PCA/EFI real return data (shown below) spans numerous market and economic scenarios. As the summary information highlights, both returns and risks have proven erratic over the last 3½ decades.

Figure 31 – PCA/EFI Real Return Data Set

Year	Cash	Private Equity	Real Estate	Fixed Income	US Equity	Non US Equity	CPI
1970	1.1	-41.7	2.3	12.1	-1.6	-16.0	5.5
1971	1.0	-1.6	5.8	6.5	10.9	27.8	3.4
1972	0.7	6.6	4.6	2.8	15.6	34.2	3.4
1973	-1.6	-45.8	-3.9	-6.5	-23.5	-23.0	8.8
1974	-4.0	-44.6	-6.8	-12.0	-38.7	-34.3	12.2
1975	-1.0	29.3	-0.1	5.3	30.2	30.1	7.0
1976	0.3	58.0	12.7	10.8	19.1	-1.1	4.8
1977	-1.3	48.8	5.9	-3.8	-19.9	12.6	6.8
1978	-1.6	54.8	6.7	-7.6	-6.5	25.3	9.0
1979	-2.9	22.0	15.2	-11.4	10.8	-7.1	13.3
1980	-0.5	84.4	6.2	-9.7	20.1	12.0	12.4
1981	6.1	-18.2	6.3	-2.6	-13.3	-9.9	8.9
1982	7.4	23.5	8.1	28.7	16.8	-4.8	3.9
1983	5.1	39.9	11.8	4.6	18.9	20.8	3.8
1984	6.0	-10.6	9.6	11.1	-0.6	3.9	4.0
1985	4.0	5.2	8.0	18.3	28.4	52.9	3.8
1986	5.1	-0.2	7.3	14.2	15.6	68.9	1.1
1987	1.5	-1.6	-1.4	-1.6	-2.4	20.5	4.4
1988	2.4	4.9	3.3	3.5	13.4	23.5	4.4
1989	4.0	-0.1	2.1	9.9	24.7	7.4	4.6
1990	1.8	-10.3	-5.8	2.5	-11.2	-28.8	6.1
1991	2.6	19.3	-5.0	13.4	30.6	10.9	3.1
1992	0.6	11.0	-4.2	4.5	6.7	-14.0	3.0
1993	0.3	25.7	2.2	7.6	8.1	32.1	2.8
1994	1.5	4.7	3.1	-5.8	-2.5	3.9	2.7
1995	3.1	14.8	6.5	15.9	34.2	7.3	2.6
1996	2.4	35.2	10.4	1.6	18.9	3.8	2.9
1997	3.5	29.6	13.2	8.1	30.1	0.3	1.7
1998	3.4	23.1	11.0	5.4	22.2	12.2	1.9
1999	1.9	97.5	6.4	-2.7	18.0	27.8	2.9
2000	2.8	-37.1	9.6	7.4	-10.9	-18.7	3.4
2001	1.8	-31.4	6.5	6.3	-13.3	-21.6	1.9
2002	-0.6	-42.6	4.1	7.5	-23.9	-17.3	2.4
2003	-0.7	65.1	11.6	4.0	29.2	39.0	1.9
2004	-1.8	16.3	14.2	1.7	8.7	17.7	3.3
2005	0.0	1.6	16.3	-0.7	2.7	13.2	3.4
2006	1.6	6.8	13.8	1.8	12.5	23.5	3.4
Averages							
All 37 Years	1.5	12.0	5.9	4.1	7.5	9.1	4.7
1970s	-0.9	8.6	4.3	-0.4	-0.3	4.9	7.4
1980s	4.1	12.7	6.1	7.6	12.2	19.5	5.1
1990s	2.1	25.1	3.8	5.0	15.5	5.6	3.0
2000s	0.4	-3.0	10.9	4.0	0.7	5.1	2.8
Volatilities							
All 37 Years	2.6	34.5	6.1	8.6	18.0	22.8	3.1
1970s	1.7	41.1	6.8	9.0	21.7	24.6	3.4
1980s	2.4	30.1	3.9	11.2	13.3	24.7	3.2
1990s	1.1	28.6	6.9	6.7	15.0	17.9	1.2
2000s	1.6	38.0	4.4	3.2	18.1	24.1	0.7

74. For several data series, decade-long average returns range from negative to positive. In addition, asset class risks also fluctuate. For example, fixed income risk ranges from 3.2% during the 1990s to 11.2% during the 1980s. Equity risks also fluctuate over time. Mean-variance optimization does not allow asset class risk to take on these characteristics, which is essential for gaining a more complete awareness of plan volatility over the course of a planning horizon. In addition, mean-variance optimization also pre-supposes that asset class returns will conform to a normal distribution or lognormal distribution over time. Certain events, such as the 1987 Crash and the 2000-2002 Bear Market, provide evidence that markets do not necessarily conform to such simplifying assumptions.

75. The resampling process is valuable because it does not rely upon any pre-conceived notion of asset class distributions or correlation patterns. Resampling allows planners to incorporate all the messiness of historical variability into the planning process. By adjusting the historical data set to conform to at least *the level* of expected returns, we hope to capture the best of what both mean-variance and resampling approaches have to offer. Also, to the extent that planners wish to have the resampling process better reflect certain mean variance assumptions, certain windows of time within the dataset can be used for simulation purposes. Such "scenario-based" analyses may shed additional light onto the projected dynamics of a pension plan's financial condition.

Appendix I

PCA/EFI Mean-Variance Expected Asset Class Returns, Risks, and Correlations

Average Annual Risk Premiums - %

Real Risk-Free Rates	
Shorter-term	1.50
Longer-term (10-year TIPS yield)	2.50
Risk Premiums over Short-term Real Risk-free Rate:	
Domestic Core Bonds	1.25
International Bonds	1.25
Global Bonds	1.25
Core Real Estate*	3.00
Domestic Stocks	5.00
International Stocks	5.00
Hedged International Stocks	4.90
Alternative Investments/Venture Capital	8.50

Nominal Return and Risk Estimates (in %) —2.50% Long-term Inflation Assumption

	Expected Avg. Nominal Annual Return	Expected Risk of Nominal Returns (Annlzd. SD)
Short-term	4.00	2.0
Treasury Inflation Protected Securities	5.00	4.5
Domestic Core Bonds	5.25	5.0
International Bonds	5.25	10.0
Global Bonds	5.25	8.0
Core Real Estate	7.00	10.0
Domestic Stocks	9.00	15.0
International Stocks	9.00	18.5
Hedged International Stocks	8.90	15.0
Alternative Investments/Venture Capital	12.50	32.0

Nominal Return Correlation Assumptions

	ShTm	TIPS	CoreBds	IntlBds	GlblBds	RealEst	USStks	IntlStks	HIntlStks	AltVent
TIPS	0.20									
CoreBds	0.15	0.50								
IntlBds	-0.10	0.40	0.40							
GlblBds	0.00	0.50	0.50	0.95						
RealEst	0.20	-0.20	-0.10	-0.25	-0.25					
USStks	0.00	-0.25	0.00	0.10	0.15	0.20				
IntlStks	-0.05	-0.25	0.00	0.25	0.15	0.10	0.60			
HIntlStks	0.10	-0.25	-0.25	-0.15	-0.15	0.25	0.70	0.80		
AltVent	0.10	-0.35	-0.20	0.00	-0.15	0.10	0.75	0.60	0.75	
CPI	0.40	0.30	-0.30	-0.25	-0.25	0.25	-0.15	-0.10	0.25	0.10

Appendix II

Asset Class Benchmarks Used for Analysis

When establishing expectations for future asset class returns and risks, PCA/EFI utilizes numerous indices that cover a broad spectrum of investable asset classes (see table below).

Selected Asset Classes Utilized by PCA/EFI

Asset Class	Benchmarks Utilized
Cash	Merrill Lynch 90-Day Treasury Bills
US Fixed Income	Lehman Intermediate Government Bond Index Lehman Long Government Bond Index Lehman Credit/Corporate Index Lehman Government/Corporate Index Lehman Government/Credit Index Lehman Global Aggregate Index Lehman Aggregate Index Lehman Universal Index
Real Estate	NCREIF Property Index Wilshire REIT Index NAREIT Equity REIT Index
US Equities	Standard & Poors 500 Index Russell 3000 Index Russell 2000 Index
Non US Equities	MSCI EAFE Index MSCI EMF Index MSCI ACWI ex-US Index MSCI Hedged EAFE Index
Non US/Global Fixed Income	Citigroup Non US Government Bond Index Citigroup Global Government Bond Index Citigroup Hedged Non US Government Bond Index Citigroup Hedged Global Government Bond Index
Private Equity	Brinson Venture Capital Index (discontinued) VCJ Post-Venture Capital Index

ANNEX II

Pension Consulting Alliance/EFI Actuaries

Asset Class Benchmarking and Implementation Issues

February 2007

Contents

Chapter I

Introduction

1. A key aspect of the 2007 UNJSPF Asset Liability project is the selection of a spectrum of strategic asset classes as potential candidates for long-term investment by the UNJSPF. The asset-liability modeling process then selects all, or a subset of these classes, as well as the amount of investment in each asset class, depending on the risk tolerance adopted by UNJSPF decision makers. Final policy recommendations/decisions may include all asset classes, or exclude any subset of asset classes.

2. While specific asset class implementation guidance and analysis is beyond the scope of the asset-liability study, this Annex provides an overview and description of each asset class under consideration and outlines several aspects associated with investing in each asset class. Upon completing this Annex, the reader should have developed a reasonable sense of the purpose and tradeoffs associated with investing in each asset class. Information in this annex is not all-inclusive and represents a beginning point for discussion to the extent that UNJSPF determines that exposure to specific asset classes would be appropriate. Such asset class design and implementation issues would naturally follow any asset allocation decision and be addressed before any new asset classes receive funding.

3. There are seven additional chapters in this Annex. Each of the remaining seven chapters covers a single asset class. The asset classes reviewed include: Global Public Developed Markets Equity, Global Investment-Grade Fixed Income, Emerging Markets Equity, Emerging Markets Fixed Income, Real Estate, Real Return, and Private Equity.

4. An important aspect of the strategic asset allocation process is to include as broad a range of viable opportunity sets as possible for investment. In this respect, policy decision makers typically begin with a set of investment options that cover nearly the entire investment universe. From this point, decision makers will eliminate certain portions and exposures to the universe depending on risk tolerance and preferences. The final outcome is a policy portfolio representing that portion of the investment universe that is acceptable to the consensus decision-making bodies.

5. One criterion for initial inclusion in an investable universe is the absolute size of the opportunity set. One metric used within the investment community to determine absolute size is the current market value of an asset class. All of the asset classes above contain at least $1 trillion USD of assets (with a few being large multiples of that size). At this minimum size level, plan sponsors such as the UNJSPF can typically be assured that institutional participation in the respective asset class is significant. Despite their significant size, each asset class presents different challenges in terms of portfolio structuring, implementation, and monitoring. These latter considerations are beyond the scope of the UNJSPF Asset-Liability project and are typically dealt with during the implementation phase. This report, however, will provide the reader with a useful outline of the issues at hand within a specific asset class to the extent the UNJSPF selects such an asset class for investment.

6. In addition to the above general criteria, the UNJSPF (per General Assembly Resolution 35/216) has also established several specific criteria that an asset class must meet in order for consideration as being investable by the UNJSPF. These criteria are:

a. *Prudent world-wide diversification* – in the context of the total investment portfolio, an asset class must exhibit reasonable geographic, risk, and investment vehicle diversification attributes;
b. *Safety* – investment in an asset class should contribute to safety of the principal of the overall portfolio by diversifying against downside risk;
c. *Profitability* – asset classes are expected to provide long-term profits to overall portfolio, ensuring that principal will grow at an acceptable rate over time;
d. *Liquidity* – marginal investments in one or more asset classes should not detrimentally impact the overall portfolio's ability to meet the Plan's cash flow requirements in a timely and cost effective manner;
e. *Convertibility* – investments in one or more asset classes should not restrict the overall portfolio from easily converting appropriate funds into the U.S. Dollar;
f. *Developing country exposure* - whenever possible (but mindful of the above principles) investment in developing countries should be considered;
g. Investments should be made with the *best interests of the participants, retirees, and beneficiaries* and of the morale and efficiency of the international civil service; and
h. *Duration of investment* – given the overall Plan's long-term liability perspective and long-term investment horizon, asset class investments should also be viewed as being allowed to achieve their investment objectives over generally long-term planning horizons.

7. As the above criteria highlight, these considerations should be viewed as being applied at the total portfolio level. For example, the UNJSPF has made significant investments in real estate, which itself, is a relatively illiquid asset class. However, the impact of real estate on overall portfolio liquidity is not a concern because the overall portfolio has substantial investment in other highly liquid investments. In addition, real estate proves highly advantageous in addressing several of the other criteria.

Chapter II

Global Public Developed Markets Equities Asset Class

8. Global public market equity is the largest asset class in the UNJSPF investment portfolio, having a policy allocation 60% of total assets.

Description

9. Equity ownership interests in companies located both in and outside of the United States, including companies residing in the developed economies of Continental Europe, the United Kingdom, Japan, and several Pacific Basin countries. While there are varying definitions of the term "developed economies," developed markets are typically characterized by (i) relatively high per capita gross domestic product, (ii) well-established financial market infrastructure, (iii) U.S.-like or better corporate governance and market regulatory structures, (iv) significant market liquidity and ease of executing and settling securities transactions, and (v) well-established markets for the currency that is used to conduct commerce with the respective country or market.

10. As of the end of 2006, the market value of the Global Equities asset class totaled over $35 trillion, on a float-adjusted basis. This includes companies ranging from the world's largest (e.g., Exxon, General Motors, Toyota, British Petroleum, WalMart, etc.), termed "large capitalization" or "large cap" companies, to companies having a market value of approximately $200 million. Depending on the index provider, a company would be considered "small capitalization" or "small cap" if its total value was less than $8.5 billion (Dow Jones/Wilshire) or $3.6 billion (MSCI) as of April 2007 and September 2006, respectively.

Developed Market Size Allocations by Regional Segments
(as of 12/31/2006)

	Asia exJpn	Japan	North America	Europe	Total Developed
Dow Jones/Wilshire					
Large	86.8%	90.7%	87.3%	89.3%	88.2%
Small	13.2%	9.3%	12.7%	10.7%	11.8%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
MSCI					
Large	83.0%	84.0%	84.7%	87.7%	85.5%
Small	17.0%	16.0%	15.3%	12.3%	14.5%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Russell					
Large					90.3%
Small					9.7%
Total					100.0%
Note:					
Average Small Cap Allocation					12.0%

11. The table above highlights that small cap exposure averages 12% of total assets for the entire developed market universe, but can vary depending on the benchmark selected.

PCA-EFI considers a 12%-15% level to be the default strategic allocation range for small cap equity within diversified global developed markets equity portfolios.

12. As might be expected, all indices cite North America (largely the U.S.) as the largest regional allocation within the developed markets (see table below).

Developed Market Size Allocations by Regional Segments
(as of 12/31/2006)

	North America	UK	Euro ex UK	Japan	Asia ex Jpn	Total
Large Cap						
Russell	53.8%	10.9%	25.0%	8.9%	1.5%	100.0%
Dow Jones/Wilshire	50.0%	9.9%	20.8%	11.9%	7.4%	100.0%
MSCI	54.1%	11.0%	20.3%	11.0%	3.6%	100.0%
Average	52.6%	10.6%	22.0%	10.6%	4.2%	100.0%
Small Cap						
Russell	51.8%	9.3%	20.6%	14.4%	3.9%	100.0%
Dow Jones/Wilshire	51.5%	11.4%	19.5%	9.4%	8.2%	100.0%
MSCI	59.3%	9.0%	16.6%	11.0%	4.1%	100.0%
Average	54.2%	9.9%	18.9%	11.6%	5.4%	100.0%

13. Both the U.K. and Japan each account for approximately 10-11% of the developed markets allocation, while Asia ex-Japan accounts for 4%-5%. The Europe ex-UK allocation varies depending on capitalization. Again, we would consider these regional allocations to be the default strategic allocation levels within a diversified global developed markets portfolio.

Objective

14. Produce high real returns, with the long-term premium over long-term default free bonds (the risk premium) ranging from 2% - 6%. Global equities are also considered a reasonable, but imperfect, long-term hedge against active (non-retirement) liabilities.

Key Risks

15. There are numerous risks associated with investing in the global equity markets. Significant risks include: (i) absolute risk (the risk of significant declines in value), (ii) liability hedging risk (the risk of not tracking liability growth), (iii) regulatory risk (risk that a certain market or markets will adjust regulations to the detriment of investors), (iv) political risk (risk that governmental policies not related to market regulation will adversely impact market values), (v) currency risk (risk that base currency of local market will decline versus the investor's base currency), (vi) company-specific risk (risk that company activities/decisions significantly reduce the value of a company above-and-beyond overall market factors), (vii) benchmark risk (risk that the policy benchmark selected by the investor does not fully reflect the behavior of the global equity investable universe), and (viii) tracking risk (risk that the actual investor's portfolio does not perform within an adequate range around the selected policy benchmark).

Potential Benchmarks

16. While selection of a specific benchmark for this asset class is beyond the scope of this project, this section reviews several key points associated with selecting an appropriate benchmark. Currently, the UNJSPF utilizes the MSCI All Country World Index as its global equity benchmark. This benchmark is a market-weighted combination of both developed country equity and emerging country equity markets. However, there is only a negligible allocation to small capitalization companies within this benchmark. Depending on the final approved policy, discrete strategic allocations to developed markets and emerging markets may be required. The Global Developed Markets Equity asset class contemplates a move in that direction. Potential benchmarks that the UNJSPF might consider for use as a policy benchmark for global developed market equities include:

(i) Russell Global Equity Developed Market Index
(ii) Citigroup Broad Developed Market Index
(iii) Dow Jones/Wilshire Global Indexes
(iv) MSCI Enhanced Developed Market Index (phased in over 2007/2008)

17. All of the above benchmarks include a small cap segment with segment allocations ranging from 9% to 14% of total benchmark market value. In addition, these broad policy benchmarks can be systematically divided into other factor-oriented benchmarks, including investment style (value vs. growth), economic sectors, geographic regions, etc.

Implementation Considerations

18. There are numerous implementation considerations related to global equity investing. Key considerations include:

(i) Active vs. Passive. The active vs. passive decision relates to the investor's belief/confidence that there is an ability to outperform all or a portion of the benchmark. If the investor lacks confidence in the ability of investment advisors to add value, then the investor will likely be satisfied with a passive (indexing) approach that seeks only to achieve and maintain exposure to all or a portion of the asset class. For large-scale investors such as the UNJSPF, the cost of the indexing approach is minimal. If the investor has confidence that added value can occur across all or a portion of the market, *net of fees*, the investor will likely seek external expertise, or develop internal expertise, to exploit added value opportunities. Importantly, for large scale funds such as the UNJSPF, the retention of too many competing active strategies may result in strategy overlap/redundancy. Under such conditions, the investor could end up with an aggregate portfolio that behaves like an index fund, but the fee costs are significantly greater than an overall passive approach. Costs for active management approaches across developed markets portfolios range from 0.25% to 1.0%, depending on the strategy employed. To the extent that active management is desirable, the investor will likely utilize a spectrum of active approaches in order to manage the risk associated with achieving that added value. Diversifying of added value approaches, if applied in a disciplined manner, should improve the consistency of added value results.

(ii) Strategic Structure. The strategic structure of a global equity portfolio can take numerous forms. Such structure will typically revolve around two issues: (i) does the investor wish to over/underweight certain major market factors (such as country/region and/or investment style factors, etc.)?, and/or (ii) where does the investor believe added value is possible (certain countries, regions, economic sectors, market segments such as large vs. small, etc.)? Tilting a portfolio toward or away from certain macro factors causes the overall portfolio to exhibit an absolute risk pattern that may prove materially different than the policy benchmark for an extended period of time. PCA typically advises its clients against taking significant major factor tilts versus the policy benchmark. Exploiting certain added value opportunities within certain segments of the portfolio, if designed correctly, should leave overall portfolio macro factor risk equivalent to that of the policy benchmark. The key risk in this case is the consistency of the combined added value approaches and whether any lack of consistency is within the investor's tolerable level.

Institutional Usage

19. In 2006, the 1,000 largest defined benefit plans in the United States had allocated approximately 61% of total plan assets to public market equity assets. This level was down slightly from 2005, when equities amounted to 62% of assets.[25] In a broader survey of nearly 2,000 plans by Greenwich Associates in 2005, the average allocation to public market equities was 61%.

[25] Source: Pension & Investments, January 22, 2007.

Chapter III

Global Investment-Grade Fixed Income Asset Class

20. Global public developed markets fixed income is the second-largest asset class in the UNJSPF investment portfolio, having a policy allocation of 30% of total assets.

Description

21. Financial obligations, with finite lives, of companies, governmental entities, agencies, banks, and insurance companies domiciled predominantly in the developed economies of the United States, Continental Europe, the United Kingdom, Japan, and several Pacific Basin countries. Securities of countries and other entities are deemed investment-grade by the investment industry if they are rated at least an equivalent of BBB- by two of three rating agencies.[26]

22. As of the end of 2006, the market value of the Global Investment-Grade Fixed Income asset class totaled over $23 trillion. This includes issuance in several countries that may have been considered "emerging" in prior years (e.g., Poland and South Korea). In addition, while credit issuance has grown dramatically over the last five years, to almost $10 trillion, government-related issuance has increased as well as the United States has continued to fund its growing deficits, Japan remains a significant debtor nation, and other countries have been able to issue investment-grade debt.

Objective

23. Produce stable real returns and income, with a modest premium over long-term default free bonds (the risk premium). Global fixed income is also considered a solid diversifier against global equity volatility and a reasonable hedge against short-to-intermediate (retirement) liabilities.

Key Risks

24. There are numerous risks associated with investing in the global investment-grade fixed income markets. Significant risks include several associated with trends in interest rate volatility: (i) duration risk (volatility associated with changes in interest rates across the entire maturity spectrum), (ii) convexity risk (the potential that risk might accelerate as interest rate volatility increases), (iii) default risk (risk associated with the borrower's/issuer's ability to pay its obligations), (iv) political risk (risk that governmental policies not related to market regulation will adversely impact market values), (v) currency risk (risk that base currency of the local market will decline versus the investor's base currency), (vi) reinvestment risk (risk that bond income may not be reinvested in similarly yielding securities), (vii) yield curve risk (risk that the shape of the yield curve changes to the detriment of the bond holder), and (viii) structure risk (risk arising from underlying options embedded in bonds that could prove detrimental to the bond holder).

[26] Ratings can range from high-quality investment-grade debt rated AAA (e.g., United States, Norway, Germany, and France exhibit AAA ratings on their sovereign debt) to below-investment-grade (i.e., <BBB- rating). For example, Turkey, Pakistan, and Venezuela debt have ratings of B and thus would be considered below-investment-grade. Source: BIS. Currently, UNJSPF policy allows investment in fixed income securities with a minimum rating of A.

Potential Benchmarks

25. While selection of a specific benchmark for this asset class is beyond the scope of this project, this section reviews several key points associated with selecting an appropriate benchmark. The UNJSPF currently utilizes the Lehman Global Aggregate as its policy benchmark for this asset class. Based on the list below, the Lehman Global Aggregate is also considered a viable benchmark going forward. One issue is the current exclusion of the global corporate high yield segment, as this segment is not included in either the Lehman Global Aggregate or the proposed emerging market benchmarks. Corporate high yield fixed income consists of those corporate bonds whose ratings are below investment-grade (i.e., <BBB- or equivalent). Based on Lehman data, global corporate high yield fixed income approximated $800 billion in value, consisting largely of U.S. corporate high yield, high yield CMBS, and European high yield. In order to include corporate high yield, the UNJSPF would likely have to enter into discussions with the appropriate benchmark provider to create a custom index.

26. Potential benchmarks that the UNJSPF might consider for use as a policy benchmark for Global Investment-Grade Fixed Income are:

Lehman Global Aggregate
Merrill Lynch Global Broad Market Index
Merrill Lynch Global Master Index

Implementation Considerations

27. There are numerous implementation considerations related to global fixed income investing. Key considerations include:

(i) Active vs. Passive. In addition to the preceding active vs. passive comments, fixed income offers its own unique challenges. This is particularly evident today as intermediate and longer-term yields are near their historic lows. If one believes that such a condition exists, then passive management may almost assure the investor of relatively low returns if and when the yield curve reverts to its normalized condition. In such cases, actively-managed fixed income may prove advantageous. Costs for active management approaches across investment-grade fixed income portfolios range from 0.15% to 0.50%, depending on the strategy employed. To the extent that active management is desirable, the investor will likely utilize a spectrum of active approaches in order to manage the risk associated with achieving that added value. However, unlike equities, active investment-grade fixed income strategies may be more highly correlated and less discernible from one another. Therefore, an investor's due diligence should focus strongly on what distinguishes one active fixed income strategy from another.

(ii) Strategic Structure. At the scale of UNJSPF's fixed income portfolio, a critical issue is whether a structure focusing on dedicated (regional/sector) specialists should be established, in contrast to a structure utilizing more broad discretionary approaches. Within the fixed income markets, highly discretionary but risk-controlled processes appear to be the most advantageous to the extent that one can identify global fixed income

expertise that has both regional and sector resource depth. Another major consideration within this asset class is whether the UNJSPF would want to pursue corporate high yield mandates. Currently, the corporate high yield segment is not addressed explicitly in the UNJSPF asset class structure. PCA-EFI would recommend that policy allow for high yield exposure (either tactically or strategically) within this asset class.

(iii) Currency Risk. While the asset-liability model may provide an indication of the usefulness of strategic hedging at the total portfolio or asset class level, it is widely recognized that currency is a major risk factor to consider when managing global fixed income portfolios. Currency management (whether in the form of risk management or active management) should be a key skill set evident in portfolio managers managing global fixed income on behalf of the UNJSPF.

(iv) Rapidly Evolving Markets. The global fixed income markets are evolving at an extremely rapid pace with the inclusion of new markets and instruments (e.g., the growth of global credit default swaps, the growth in interest rate futures markets, the development of inflation-protected instruments, etc.). Practitioners that have developed strong skill sets in the evolving areas should be considered as viable alternatives for managing fixed income assets.

(v) Fixed Income Risk Management. It is important that the Fund's Investment Management Service be equipped with the appropriate IT infrastructure for a Fund of its scale and to have the operational and risk management systems to trade, settle, record, reconcile and monitor its Fixed Income portfolio and manage the associated risks (e.g. yield curve, currency, structure, credit, etc.) in a controlled, effective and efficient manner.

Institutional Usage

28. In 2006, the 1,000 largest defined benefit plans in the United States had allocated approximately 27% of total plan assets to public market fixed income assets. This level was up slightly from 2005, when fixed income amounted to 26% of assets.[27] In a broader survey of nearly 2,000 plans by Greenwich Associates in 2005, the average allocation to public market fixed income was 27%.

[27] Source: Pension & Investments, January 22, 2007.

Chapter IV

Global Emerging Markets Equity Asset Class

29. Global public emerging market equities is a new asset class under consideration by the UNJSPF. The asset-liability project considered a maximum allocation of 7% to this asset class.

Description[28]

30. Emerging markets typically meet one of the two following criteria:
   a) The market represents an economy that is in the low, lower-middle, or upper-middle income tier as defined by the World Bank.
   b) Investable market capitalization relative to GDP is relatively low.

31. Other factors, including market transparency, liquidity, potential for corruption, and market size, also enter into the identification of specific emerging markets. Emerging markets are often categorized in two tiers: (i) a higher-quality tier and (ii) all others. Country markets in the high quality tier include Brazil, Mexico, South Africa, South Korea, and Taiwan. There are an additional 25+ countries that reside in the other tier. Other countries extending beyond the more well-known 30+ emerging market countries utilized by institutional investors are considered "frontier" markets.

32. As of the end of 2006, the market value of the emerging markets asset class totaled $2.5 trillion to $3.5 trillion, on a float-adjusted basis, depending on the benchmark. As with the developed markets, all of the cited benchmarks include a small cap segment with segment allocations within emerging markets ranging from 15% to 21% of total benchmark market value.

Market Size Allocations in Emerging Markets Equity
(as of 12/31/2006)

	Emerging Size Allocation
Dow Jones/Wilshire	
Large	85.2%
Small	14.8%
Total	100.0%
MSCI	
Large	84.5%
Small	15.5%
Total	100.0%
Russell	
Large	78.8%
Small	21.2%
Total	100.0%
Note:	
Average Small Cap Allocation	17.2%

[28] Op cit, Investing In Emerging Markets, Chapter 2.

Objective

33. Produce high real returns, with the long-term risk premium exceeding that of global public equities. Emerging markets are also considered a diversifier against other asset classes. However, as globalization continues, the correlation of emerging markets to other asset classes has risen, leading emerging markets to become more of a "high beta" asset class relative to global equities.

Key Risks

34. The risks associated with investing in emerging markets equity are analogous to those of global equity markets, but magnified to some degree. As discussed above, key distinguishing risks of emerging markets include: (i) market transparency risk (relative lack of information flow versus more developed markets), (ii) liquidity risk (ability to rapidly set fair prices and conduct transactions in a timely manner), (iii) governance risk (potential lack of shareholder control relative to governance standards in the developed markets), (iv) corruption risk (potential that local governments will influence economic activity utilizing unethical and criminal methods), and (v) political risk (potential that local government will establish market-related policies that deviate significantly from capital market norms). Currency risk may also prove critical, but is difficult to manage because many emerging currency markets are still in their early stages of development.

Potential Benchmarks

35. While selection of a specific benchmark for this asset class is beyond the scope of this project, this section reviews several key points associated selecting an appropriate benchmark. Potential benchmarks that the UN might consider for use as a policy benchmark for emerging markets equities include:

(i) MSCI Enhanced Emerging Markets Free Index (in development 2007-2008)
(ii) S&P/IFC Emerging Markets Index
(iii) Russell Emerging Markets Index
(iv) Dow Jones/Wilshire Emerging Markets Index

Implementation Considerations

36. There are numerous implementation considerations related to emerging markets equity investing. Key considerations include:

(i) Active vs. Passive. Given the relatively high level of inefficiency and lack of transparency within numerous emerging markets, the majority of investors consider active management the default approach. However, as the emerging markets continue to evolve into higher-quality and lower-quality tiers and more tools for risk management become available, passive management, particularly within the upper-tier country markets, becomes feasible.
(ii) Strategic Structure. The emerging markets are evolving to exhibit style behaviors analogous to those of developed markets. However, country allocation considerations remain dominant in the risk management of emerging markets portfolios. Keeping these factors in mind, it is critical that any large-scale emerging markets portfolio rely on a multiple-manager structure to implement an

investment strategy. Each manager should prove highly complementary to other managers in terms of their approach to adding value. Given the level of inefficiency in the emerging markets, complementary styles can reduce both absolute and benchmark-relative risk substantially. Many institutional investors have allowed their developed markets managers to make tactical allocations to emerging markets. This approach can lead to emerging markets portfolios that are less diversified than an approach that assigns dedicated managers to emerging markets mandates. Given the size and scale of the UNJSPF investment portfolio, and that the UNJSPF has elected to treat emerging markets as a separate asset class, dedicated expertise and mandates are warranted.

Institutional Usage

37. In 2006, the 200 largest defined benefit plans in the United States had allocated approximately 11% or $68 billion of their international equity assets to emerging markets equity.[29] According to InterSec, a leading researcher of international institutional investment trends, as of year end 2005, all U.S. pension funds had allocated 10%, or $106 billion, of their international equity assets to emerging markets equity mandates.[30]

[29] Source: Pension & Investments, January 22, 2007.

[30] 2005 Year-End Investment Industry Research Report of the U.S. Tax Exempt Cross Border Marketplace, InterSec Research, 2005.

Chapter V

Global Emerging Markets Fixed Income Asset Class

38. Global public emerging market fixed income is a new asset class under consideration by the UNJSPF. The asset-liability project considered a maximum allocation of 4% to this asset class.

Description

39. Descriptions of emerging market fixed income markets typically take on either one of two key criteria:[31]

a) The market represents an economy that is in either the low or middle income tiers as defined by the World Bank.
b) Issuance of a sovereign nation or debt within the respective sovereign nation is rated below a pre-specified investment-grade rating.

40. Emerging market fixed income typically trades in U.S.$-based or Euro-based instruments. This characteristic is changing; several emerging markets currencies have developed reasonably liquid markets. One trend is that several of the emerging markets index providers are beginning to publish and incorporate local-currency indices into their families of emerging markets indices. Country weightings can vary dramatically, depending on the benchmark selected. In addition, corporate issuance is beginning to grow into a material proportion in a few of the indices.

41. As of the end of 2006, the market value of the emerging markets fixed income asset class exceeded $3.5 trillion.[32] Nearly one-half of the asset class consists of issuance in the Asia-Pacific region, with China and South Korea being the largest issuers. One other issuer of similar scale is Brazil.

Objective

42. Produce a long-term risk premium that exceeds that of global investment-grade fixed income. Emerging markets fixed income is also considered a diversifier against other asset classes. However, as globalization continues, yield spreads between emerging markets issuance and developed markets issuance have declined to historically low levels, causing potential income improvement versus developed market issuance to decline.

Key Risks

43. The risks associated with investing in emerging markets fixed income are analogous to those of global investment-grade markets, but magnified to a degree as a result of increased potential default risk associated with both sovereign-issued and corporate-issued debt. Significant risks include several associated with trends in interest rate volatility: (i) duration risk (volatility associated with changes in interest rates across the entire maturity spectrum), (ii) default risk (risk associated with the borrower's/issuer's ability to pay its obligations), (iii) political risk (risk that governmental policies not

[31] Sources: JP Morgan, Lehman Brothers.

[32] Brauer, Jane, Emerging Markets: Tradable Debt Reaches $3.4 Trillion," Emerging Markets Debt Monthly, June 2005.

related to market regulation will adversely impact market values), (iv) currency risk (risk that base currency of local market will decline versus the investor's base currency), (v) reinvestment risk (risk that bond income may not be reinvested in similarly yielding securities), (vi) yield curve risk (risk that the shape of the yield curve changes to the detriment of the bond holder), (vii) structure risk (risk arising from underlying options embedded in bonds that could prove detrimental to the bond holder), (vii) event risk (emerging market fixed income responds rapidly and significantly to positive or negative macroeconomic factors), and (viii) potential contagion risk (risk that events in one market could adversely impact other markets).

Potential Benchmarks

44. While selection of a specific benchmark for this asset class is beyond the scope of this project, this section reviews several key points associated with selecting an appropriate benchmark. Potential benchmarks for this asset class are:

(i) JP Morgan Emerging Markets Bond Index Global (EMBI) or EMBI Global Diversified
(ii) Merrill Lynch Global Emerging Markets Plus Index
(iii) Lehman Global Emerging Markets Index

Implementation Considerations

45. There are numerous implementation considerations related to emerging markets fixed income investing. Key considerations include:

(i) Active vs. Passive. Given the relatively high level of inefficiency and potential lack of transparency within numerous emerging markets, the majority of investors consider active management of emerging markets fixed income the default approach.
(ii) Strategic Structure. While exposure to corporate issuance is growing, sovereign debt is still the largest component of the emerging markets fixed income markets. As a result, strong macroeconomic and global resources are critical for implementing a successful emerging markets fixed income program. In certain cases, given differentiated skill sets across investment advisors, specialty and/or niche approaches can prove helpful, particularly on a regional basis. In addition, one should expect that the volatility of emerging markets fixed income portfolios to be more equivalent to equity volatility rather than core fixed income volatility. In such cases, a reasonable level of manager diversification should help manage the potential of event risk having a larger than expected adverse impact upon the asset class portfolio.
(iii) Currency Risk. Since currency trading and hedging may prove difficult and impractical in many emerging markets, managing hedging risk may not be viewed as a key priority. However, since currency risk is a dominant contributor to overall global fixed income risk, a key awareness of factors impacting currencies and exchange rates is critical, particularly as several markets evolve toward more free-floating currency regimes.
(iv) Scale of Mandates. Given the limited funding of emerging market fixed income mandates, a commitment by the UNJSPF may prove to be substantial. This could pose stresses not only on specific investment advisor portfolios, but also

have a marginal impact upon returns of the asset class. As a result, it is likely that the UNJSPF should develop an asset class funding strategy that takes its scale issue into account – with one outcome being a strategy that builds exposure to a longer, rather than shorter, period of time.

(v) Rapidly Evolving Markets. The global fixed income markets, including emerging markets, are evolving at an extremely rapid pace with the inclusion of new markets and instruments (e.g., EMD default swaps). It is expected that development and usage of such instruments will increase at a relatively rapid pace over the next investment cycle. Practitioners that have developed strong skill sets in these evolving areas, particularly with respect to emerging markets, should be considered as viable alternatives for managing fixed income assets.

Institutional Usage

46. In 2006, the 200 largest defined benefit plans in the United States had allocated only $11 billion of assets (less than 0.3% of total assets) to emerging markets fixed income mandates.[33] According to InterSec, a leading researcher of international institutional investment trends, as of year end 2005, all U.S. pension funds had allocated less than $20 billion to emerging markets fixed income mandates.[34]

[33] Source: Pension & Investments, January 22, 2007.

[34] 2005 Year-End Investment Industry Research Report of the U.S. Tax Exempt Cross Border Marketplace, InterSec Research, 2005.

Chapter VI

Real Return Asset Class

47. Real Return is a new asset class under consideration by the UNJSPF. The asset-liability project considered a maximum allocation of 3% to this asset class.

Description

48. A collection of smaller asset classes whose valuations relate directly to producing a real yield or a real rate of return (i.e., maintaining purchasing power versus inflation). Such asset classes include, but are not limited to: global treasury inflation protected securities (global TIPS), timber, commodities, low-volatility hedge funds or hedge fund-of-funds, unlevered infrastructure, among others.

49. In developing a model for this asset class, PCA assumed that global TIPS would represent a core position that is then surrounded by equal-weighted proportions in the other minor asset classes.[35] Actual implementation of strategies in this asset class may prove to be more opportunistic in nature and may not conform directly to this modeled structure. We note the real returns generated by the modeled asset class produced relatively stable real returns in relation to the other asset classes.

50. As of the end of 2006, the market values of the major segments within the Real Return asset class amount to several trillion, including infrastructure. Global TIPS exceeded $930 billion.[36] Timberland, including government holdings, exceeded $500 billion.[37] In addition to the several billions traded in single-commodities futures, there was approximately $100 billion of notional value held in commodity indices in mid-2006.[38] Estimates of the value of infrastructure investments, a newly forming asset class, exceed $2 trillion.[39]

Objective

51. Produce a relatively long-term risk premium between that of fixed income and equities, with fixed income-like volatility. This asset class would be a key diversifier against other equity-oriented asset classes.

Key Risks

52. There are numerous risks associated with establishing and investing in a real return asset class. Since this asset class would very likely contain numerous investment

[35] Using mean-variance optimization to develop "optimal" weightings of segments within this asset class is problematic. First, mean-variance optimization assumes a time series of returns where there is no autocorrelation within the time series. One of the considered asset segments, timber, exhibits the highest autocorrelation of all investable asset classes, introducing potentially huge biases into the optimization process. Second, we believe that TIPS provide an excellent core position because they are (i) designed to produce real returns and (ii) have ample liquidity due to their broad usage across the global markets. Finally, certain segments within this asset class may not have ample long-term track records for modeling purposes (e.g., low volatility hedge funds, commodities). Given these issues, PCA believes an equal-weighting scheme is an appropriate approach for modeling purposes, with the exception of TIPS, which is a larger component, providing liquidity and a funding source for the other segments.

[36] Source: Lehman Live.

[37] Sources: Forest Investment Associates, Mercer.

[38] Source: CBOT Reference DJ-AIG Reference Guide, December 2006.

[39] Sources: RREEF, MacQuarie.

structures, the risks associated with this class could be considered a combination of risks experienced by the other asset classes. Several risks include, but are not limited to: (i) real interest rate risk (TIPS volatility is associated largely with the risk and level of real interest rates, which reflect expected prospects for economic growth. Rising and volatile growth will increase TIPS risk), (ii) commodity volatility risk (passive investing in commodities can be highly volatile and subject the investor to long-term commodity pricing trends), (iii) new structure risk (some investments, such as infrastructure, may be structured as limited partnerships or similar vehicles, leading to the need for higher levels of due diligence, analysis, and monitoring), (iv) transparency risk (consistent with "new structure risk," certain investments may lack transparency into portfolio holdings, e.g., hedge funds and/or hedge fund of funds), (v) liquidity risk (certain assets, such as timber, infrastructure, and certain hedge funds, may exhibit significant long periods of time before capital is returned to the investor), and (vi) correlation risk (if specific strategies or classes exhibit higher-than-expected correlations among themselves, then the asset class may not meet its original risk-adjusted objective).

Potential Benchmarks

53. While selection of a specific benchmark for this asset class is beyond the scope of this project, this section reviews several key points associated with selecting an appropriate benchmark. There are no widely-accepted benchmarks for this asset class. Institutional investors, particularly public pension funds, are just now beginning to consider and implement similar asset class structures. Reflecting the real return aspect of this asset class, as well as the intention to produce a relatively stable return, the following benchmarks might be considered:

(i) LIBOR + 3.0% to 4.0%
(ii) CPI + 5.0%
(iii) 10-Year TIPS + 2.5%
(iv) Global TIPS + 1.5% to 2.5%

Implementation Considerations

54. There are several implementation considerations related to the real return asset class. Key considerations include:

(i) <u>This is a New Asset Class.</u> If approved and implemented, the UNJSPF would be one of the first pension funds to invest in such a class. On the one hand, the UNJSPF would be a lead innovator in adopting leading-edge applications into its portfolio. On the other hand, there is risk associated with embarking on new strategies. In this respect, the UNJSPF would be "learning as it goes," possibly having to create new frameworks rather than relying on previously proven templates.
(ii) <u>New Policies, Procedures and Guidelines.</u> To begin the implementation process, the UNJSPF would very likely begin by establishing new policies, procedures, and guidelines for investment activities associated with this asset class. While templates exist for other asset classes in general, specific aspects and rules associated with this asset class would have to be created. In this scenario, policies, procedures, and guidelines might begin by taking on broader, more general features, with more specific clauses created as the asset class evolves.

This process will likely require significant attention to detail and an ongoing acceptance of change.

(iii) Active vs. Passive. For the core TIPS position, much of the rationale considered for global fixed income applies: given the current trend of relatively low long-term real interest rates, if they revert to more historical levels, passive approaches may underperform. In contrast, active approaches may position the TIPS portfolio to better respond to such challenging trends. Therefore, active management of TIPS is the preferred approach. Similarly, several of the other asset segments lend themselves to active, rather than passive management. Commodities, for example, offer potentially valuable diversification characteristics. However, on a passive basis, they are 50% more volatile than equities and are known for long periods of trending return behavior. Given such patterns, passive management of commodities could lead to very poor investment return results. Similarly, for timber and infrastructure, there is no capability available to "index" these segments. Active management is the only considerable option.

(iv) Strategic Structure. As discussed elsewhere in this section, TIPS should represent a core holding in this asset class. Reasons for this position include (i) the design of TIPS is to provide a long-term real return, consistent with the objective of the asset class, (ii) TIPS are easily marketable securities, providing ample liquidity and a funding source for the various other segments in this asset class, (iii) the TIPS markets are large, approaching $1 trillion globally, allowing for significant diversification across this segment. Other investment opportunities should be considered on an opportunistic basis for their ability to complement the expected TIPS return pattern and to stabilize the overall asset class's return pattern. Allocation to these segments remains critical because there are instances in economic cycles where TIPS can underperform.

(v) Possible Requirement for New Staffing and Expertise. In contrast to the other classes, the real return asset class would likely evolve into a multi-class portfolio itself. As the class evolves, it would require significant oversight and monitoring, probably to a degree greater than the other, more established and understood asset classes. Under such conditions, staff with solid, multi-asset class expertise (particularly private equity and/or real estate) and experience in investment program creation would prove highly valuable.

(vi) Return Stability is a Key Aspect of the Asset Class. The UNJSPF must be willing to analyze and conduct an appropriate level of due diligence on a wide array of investment types within this asset class. Through these procedures, key criteria must be to "underwrite" investments that meet reasonably strict real return level and volatility standards. In fact, staff may need or have access to an appropriate set of skills to be able to negotiate certain forms of guarantees into investment structures to ensure certain pre-specified return patterns will be met.

(vii) Disciplined Due Diligence Processing. Depending on the final approved size of this asset class, the UNJSPF could receive an overwhelming number of investment ideas for consideration. As a result, an appropriate system or set of procedures will likely need to be created to efficiently filter out and eliminate inappropriate and/or marginal ideas while continuing to process attractive ideas. This process is likely similar to procedures utilized in the real estate and private equity classes where there are various phases of the due diligence process.

Institutional Usage

55. As of the end of 2006, the largest defined benefit plans continue to contemplate real return-oriented asset classes, but this is a new phenomenon. There is modest allocation to TIPS, as the top 200 plans in the United States had allocated approximately $52 billion, or 1% of total assets to TIPS mandates.[40] Across the other real asset class segments (hedge funds, timber, commodities, infrastructure, etc.) the top 200 plans had allocated another $59 billion. So, in total, the collection of these asset classes amounted to approximately 2% of total plan sponsor assets.

[40] Source: Pension & Investments, January 22, 2007.

Chapter VII
Real Estate Asset Class

56. Real estate is the third-largest asset class in the UNJSPF investment portfolio, having a policy allocation of 6% of total assets.

Description

57. The UNJSPF real estate asset class has a design that reflects the UNJSPF's unique risk tolerance. The overall outcome of this distinct design is an asset class that is more appreciation-oriented than the typical U.S.-based income-oriented core real estate portfolio. The specific features of the UNJSPF real estate asset class are:

a) The portfolio consists of approximately 75% private real estate and 25% public real estate securities.
b) Approximately 80% of the asset class is invested in "core" real estate assets, with the remaining 20% invested in "non-core" holdings.
c) 75% of the portfolio invested inside the U.S. with the remaining 25% allocated to Non-U.S. opportunities.
d) Allowable maximum leverage for private portfolio is 20% loan-to-value.

58. It is difficult to determine precisely the size of the institutional real estate market. The U.S. real estate market has an estimated value of between $3.5 trillion and $4.0 trillion, while the institutional non-U.S. real estate market likely exceeds $2.0 trillion.[41] Given the wide spectrum of opportunities pursued by various global investors, these estimates are likely conservative.

59. The institutional real estate asset class contains a wide variety of property types, geographic regions, and financial structures. Basic property types include office, industrial/warehouse, multi-family/apartments, and retail. The U.S. is organized into several geographic regions that reflect fundamental secular demographic trends. European and Asian markets focus on major metropolitan areas as well. Financial structures can range from 100% private equity ownership of high-quality income-producing properties, to public corporate structures (REITs) that invest in specific property types, to highly leveraged portfolios of distressed ownership interests in non-U.S. properties, mortgages, and loans.

Objective

60. Produce a long-term risk premium that lies between global fixed income and global equities. Real estate is considered a key diversifying asset for institutional investors, but it should be recognized that a significant aspect to the diversifying impact of real estate is attributable to its infrequent marked-to-market valuations versus the other public asset classes. In addition, as discussed earlier, many institutional investors have restructured their real estate portfolios to exploit the use of financial leverage to magnify the appreciation components of the investment return. These tendencies could cause real estate to produce more equity-like returns, resulting in less diversification benefits.

[41] Sources: Emerging Trends in Real Estate 2006, IPD Data Bank 2006, PCA Real Estate 2006 Market Overview, UBS Asset Management.

Key Risks

61. The risks associated with investing in real estate are numerous and unique to the asset class. Significant risks include, but are not limited to: (i) property type risk (risk that supply/demand dynamics may have a unique impact on a certain type of property and not other types), (ii) location risk (risk associated with the fact the properties are not fungible, but are subject to the economic and environmental trends of their geographic region), (iii) tenant risk (risk that tenants will not pay rents, leave prior to end of contract period, damage property, etc.), (iv) physical/functional obsolescence risk (risk that physical structure will become obsolete, requiring higher-than-planned capital investment), (v) illiquidity risk (the risk associated with the length of time it takes to market a specific property or set of properties and agree upon a transaction price). The following risks are similar to those experienced in other investments: (vi) reinvestment risk (risk that proceeds from the sale of one or more properties may not produce the cash flow levels produced by the sold property(ies)), (vi) business cycle risk (risk that a deteriorating business cycle could reduce secular demand trends for numerous property types), (vii) inflation risk (risk rents may not adjust fast enough to keep pace with inflation), and (viii) interest rate risk (risk that interest rate volatility could impact property sales strategies and the financial condition of a property's balance sheet, depending on the leverage utilized to finance the property).

Potential Benchmarks

62. While selection of a specific benchmark for this asset class is beyond the scope of this project, this section reviews several key points associated with selecting an appropriate benchmark. The UNJSPF currently utilizes the NCREIF Property Index as its policy benchmark. The NCREIF index contains largely unleveraged income-producing properties residing in the United States. In contrast, the UNJSPF real estate portfolio has become more global in nature and has evolved toward utilizing more opportunistic investment strategies and capital structures. This might suggest the need to reassess the existing policy benchmark. That being said, potential real estate benchmarks that might be utilized (in combination) by the UNJSPF include:

<u>For private real estate investments</u>
(i) NCREIF Property Index
(ii) NCREIF Open-End Diversified Core Equity (ODCE) Index
(iii) IPD Global Series of Real Estate Indices

<u>For publicly-traded real estate investments</u>
(i) S&P/Citigroup Global REIT Index
(ii) Dow Jones Wilshire Global REIT Index
(iii) FTSE/NAREIT Global REIT Index

Implementation Considerations

63. There are numerous implementation considerations related to real estate investing. Key considerations include:

(i) Active vs. Passive. Given the relatively high level of inefficiency and potential lack of transparency within the real estate asset class and its many heterogeneous segments, the majority of investors consider active management within real estate the default approach. Another key factor to consider is that all privately-held real estate requires some form of operational expertise to (i) keep the properties producing inflation-adjusted income as well as (ii) maintain the usefulness of properties within their respective property type and geographic region.

(ii) Leverage. It is well known that financial leverage magnifies the rate of return, whether positive or negative. Given that real estate's returns exhibit long-term rising and falling trends, it is critical that investors have an awareness of the current stage of the business cycle within which the property operates. In addition, leverage makes most sense when income returns are higher than the cost of leverage. Over time, however, capital flow dynamics may compress income yields on properties, causing the "positive carry" to diminish to an unacceptable level. If such a condition occurs, trending flat or negative appreciation of real estate holdings could prove significantly detrimental to overall portfolio results for an extended period of time.

(iii) Operating/Fiduciary Expertise. Real property investments require ongoing maintenance and capital investment to ensure they are to produce competitive returns-on-investment into the foreseeable future. As a result, investors require a real estate implementation infrastructure that includes operating expertise associated with property management, asset/loan servicing, and (potentially) work-out capabilities. Given these skill set and fiduciary requirements, pension fund investors typically outsource these aspects to third-party investment advisors, property managers, and other specialist firms rather than attempt to build such an infrastructure internally. As might be expected, as real estate investing has become more complex, investors view management fees associated with outsourcing these requirements as adequate compensation for the services rendered.

(iv) Strategic Structure. As discussed throughout this chapter, a real estate investment program exposes the investor to several risk factors that are relatively unique to the asset class. To manage these risks, the investor should construct, measure, and assess the portfolio across several of these dimensions, which are not limited to:

a. *Geographic and Sector Dimensions*. While real estate remains a location-oriented investment activity, the globalization of the asset class causes geographic and sector management to become more complex. Implementation capabilities should include the ability to assess real estate diversification risk on a global basis.

b. *Investment Strategy Dimensions*. Over the last several years, a spectrum of institutional real estate investment disciplines have developed, reflecting both various potential risk tolerances of the investor and a widening range of investment opportunities. Institutional investors now have the opportunity to establish allocations to a variety of strategies including: core-plus, value-added, opportunistic, and distressed, among others. As with private equity, each strategy may respond differently, depending on the current stage of the investment cycle. Diversification across various strategy types may improve returns at certain points of the investment cycle as well as stabilize return patterns at other points. On the other hand, overemphasizing one type of

strategy at the wrong point in the cycle could introduce biases in the portfolio that may prove overly unattractive at certain points. These issues point to the need to have an appropriate tactical overlay incorporated into a real estate investment strategy.

c. *Governance Dimensions*. Over the last several years, real estate fund structures have evolved away from open-ended structures, to closed-ended, limited partnership-or-equivalent structures similar to those utilized in the private equity asset class. Given this structure, the investor must be fully cognizant of the economic incentives and terms and conditions associated with this type of investment structure. In this case, either internally-developed expertise or external fiduciary representation (in the form of a consultant or other investor-oriented advocate) is critical.

d. *Commitment Pacing Considerations*. One important approach to enhancing risk in a portfolio that is oriented toward private investments is to pace funding commitments over time. Such a strategy proves advantageous given that, once funded, private investments cannot be recalled. Funding over time prevents a significant portion of the portfolio from being overly exposed to a specific stage or phase of the investment/business cycle. In addition, paced commitments allow investors to become more opportunistic in fitting certain investment strategies to certain points within the cycle.

(v) Alignment of Interests. As discussed above, institutional real estate investment activities have come to take on many of the characteristics of private equity investment. Given this shift, implementation of a real estate investment program should place significant consideration on ensuring that the investor's interests are in-line with the investment advisor's interests and vice versa. Such alignments of interest are largely reflected in the terms and conditions of the limited partnership agreement, subscription documents, and/or other analogous legal documents associated with a specific real estate investment strategy/opportunity. Given this concern, the investor should have/retain appropriate expertise to ensure its interests are communicated to the investment advisor and incorporated into the appropriate legal agreements.

Institutional Usage

64. In 2006, the 200 largest defined benefit plans in the United States had allocated approximately 4.1%, or $179.2 billion, of total assets to private real estate mandates, REITs, and mortgages.[42] According to Greenwich, a leading researcher of international institutional investment trends, as of year end 2005, all U.S. pension funds had allocated approximately $232 billion to real estate.[43]

[42] Source: Pension & Investments, January 22, 2007.

[43] 2005 Market Report, Greenwich Associates, 2006.

Chapter VIII
Private Equity Asset Class

65. Private equity is a new asset class under consideration by the UNJSPF. The asset-liability project considered a maximum allocation of 3% to this asset class.

Description

66. Ownership interests in privately-held companies in the U.S. and overseas. Broad strategies encompassing such ownership interests include leverage buyouts (LBOs), venture capital, distressed debt, mezzanine finance. Ownership interests are often consolidated into pools/portfolios of holdings in a limited partnership (or equivalent) structure. Significant direct investment in specific companies is an ancillary strategy often utilized by larger-scale investors. Direct investments typically require a higher level of resources on the part of the institutional investor.

67. Investment returns in the private equity asset class are typically calculated utilizing the internal rate of return (IRR) methodology, rather than the time-weighted return methodology utilized across the public market asset classes. IRR calculations are dollar-weighted returns that reflect the notion that the investment advisor actually controls the cash flows in and out of a specific strategy.

68. It is difficult to determine precisely the size of the institutional private equity market. Based on very broad measures, PCA estimates the private equity market had a value of over $400 billion as of mid-2006.[44] Adding in outstanding commitments for future investment puts the overall value of assets allocated to private equity close to $1 trillion. Given the wide spectrum of opportunities pursued by various global investors, this estimate is likely conservative.

Objective

69. Produce a long-term risk premium that significantly exceeds that of the public equity asset class. Reasonable expected excess returns over public equities typically range from 3.0% to 5.0% per year, on average. Private equity is considered a key return-oriented asset for institutional investors.

Potential Benchmarks

70. While selection of a specific benchmark for this asset class is beyond the scope of this project, this section reviews several key points associated with selecting an appropriate benchmark. There are no standard benchmarks utilized by investors within this asset class. Three broadly defined characteristics of private equity benchmarks are:

a) Achieve a return in excess of public equities. This return increment is associated with (i) receiving compensation for the lack of liquidity associated with private equity, (ii) a financial structure that often contains higher-than-average amounts of financial leverage, and (iii) an expectation of added value within this inefficient market.

[44] Sources: UBS Asset Management 2005 Investable Capital Market estimates, plus 1/5th of 2006 YTD private equity and venture capital commitments per Mergers & Acquisitions, Buyouts, and Private Equity Analyst.

b) Achieve a return that is in the first quartile versus other peer partnerships that finalized their formation (i.e., "closed") at the same approximate time. Research has shown that investment advisor investment results within private equity are dispersed widely – significantly more than public equity investor counterparts. This reflects a wide range of quality in partnership offerings within the institutional marketplace. A due diligence process leading to investment in high-quality partnerships should significantly increase the probabilities of meeting the first quartile standard.

c) The benchmark should account for the "J-Curve" effect. This effect reflects low and/or negative returns during the early period of a private equity investment's life cycle, with significant positive returns occurring later in the life cycle. The early low J-Curve effects are the result of the investment advisor making private investments, holding them at their cost value, and charging management fees to the advisor's investors. Later positive returns are realized upon sale of the underlying portfolio investment.

Key Risks

71. There are several unique risks associated with investing in private equity. Significant risks include: (i) illiquidity risk (the risk that the investor will not have access to invested capital for a significant period of time and will not be able to sell the investment at a reasonable price at a certain time), (ii) time horizon risk (the risk that the investment cycle could change dramatically during the holding period of the investment, which is typically 8-12 years), (iii) company-specific risk (private equity portfolios are more concentrated, resulting in higher exposure to firm-specific risks; in addition, private equity transactions can often leave acquired portfolio companies in a more precarious near-term financial condition), (iv) strategy risk (risk that investment strategy becomes obsolete during the period the investor's capital is held by the investment advisor), (v) investment advisor risk (the risk that significant organizational changes occur at the investment advisor at a time when the investor has placed significant capital under the investment advisor's authority), and (vi) exit risk (risk that the strategy for exiting a specific investment proves unattractive or becomes unavailable).

Implementation Considerations

72. There are numerous implementation considerations related to real estate investing. Key considerations include:

(i) Active vs. Passive. Given the relatively high level of inefficiency and potential lack of transparency within the private equity asset class and its many heterogeneous segments, the majority of investors consider active management within private equity the default approach. Another key factor to consider is that all privately-held investments require various forms of operational and/or financial structuring expertise.

(ii) Leverage. It is well known that financial leverage magnifies the rate of return, whether positive or negative. Certain private equity investments rely heavily on financial leverage to produce their excess returns. The investor should have an awareness of the overall amount of leverage in place across the aggregate private equity portfolio as well as the source of that leverage. Depending on the stage of

the investment/economic cycle, the investor may seek to manage its exposure to levered opportunities by limiting commitments to highly leveraged partnerships.

(iii) Operating/Fiduciary Expertise. Private equity investments require ongoing governance and operational oversight. As a result, investors require a private equity implementation infrastructure that includes operating expertise associated with corporate management, capital structuring, and (potentially) work-out capabilities. Given these skill set and fiduciary requirements, pension fund investors typically outsource these aspects to third-party investment advisors (typically in the form of general partners) rather than attempt to build such an infrastructure internally.

(iv) Strategic Structure. As discussed throughout this chapter, a private equity investment program exposes the investor to several risk factors that are relatively unique to the asset class. To manage these risks, the investor should construct, measure, and assess the portfolio across several of these risk dimensions, which are not limited to:

a. *Economic Sector and Regional Dimensions*. Since private equity is, at its core, managing corporations, corporate exposure to economic factors will have a material impact on the long-term results of a private equity portfolio. As a result, an investor should seek to measure and manage (to the best of his/her ability) exposure to appropriate economic sectors. What is critical is ensuring against any unintended biases that might enter into the portfolio over time, as investment advisors draw down and invest capital.

b. *Investment Strategy Dimensions*. As highlighted above, there are several broad strategic segments associated with private equity investing, including leverage buyouts (of various size segments), venture capital, distressed investing, mezzanine finance, etc. Diversifying across these segments, *over time*, is a reasonable strategy. One inappropriate strategy is to "hard code" allocations to such strategic segments based on one or more very imperfect benchmarks. A more appropriate strategy is to assess general capital flow data across each of these segments and to invest (or at least emphasize) certain segments depending on capital flow trends. Given the high level of inefficiency in this asset class, contrarian funding strategies may prove advantageous. PCA believes funding approaches well thought out tactical overlays are reasonable within this asset class.

c. *Governance Dimensions*. Private equity investments typically utilize closed-end, limited partnership-or-equivalent structures. Given these structures, the investor must be fully cognizant of the economic incentives and terms and conditions associated with this type of investment structure. In this case, either internally-developed expertise or external fiduciary representation (in the form of a consultant, legal advisor, and/or other investor-oriented advocate) is critical.

d. *Commitment Pacing Considerations*. One important approach to enhancing risk in a portfolio that is oriented toward private investments is to pace funding commitments over time. Such a strategy proves advantageous given that, once funded, private investments cannot be recalled. Funding over time prevents a significant portion of the portfolio from being overly exposed to a specific stage or phase of the investment/business cycle. In addition, paced commitments allow investors to become more opportunistic in fitting certain investment strategies to certain points within the cycle.

(vi) Alignment of Interests. Implementation of a private equity investment program should place significant consideration on ensuring that the investor's interests are in-line with the investment advisor's interests and vice versa. Such alignments of interest are largely reflected in the terms and conditions of the limited partnership agreement, subscription documents, and/or other analogous legal documents associated with a specific real estate investment strategy/opportunity. Given this concern, the investor should have/retain appropriate expertise to ensure its interests are being communicated to the investment advisor and incorporated into the appropriate legal agreements.

(vii) Asset Class Funding. Private equity (and real estate for that matter) is an asset class that is difficult to fund to an appropriate target level. First, investment advisors within this asset class draw down capital over time, typically 3-to-5 years. Second, investment values are typically held at cost, regardless of potential marked-to-market valuation changes that might be considered reasonable. As a result of these factors, market valuations for individual partnerships are not expected to change significantly in the early phases of a partnership's life. In addition to these "front-end" factors, private equity is a "perishable" asset class in the sense that, if it is successful, significant distributions will accrue to the investor, causing the balance of the asset class to decline once the distributions occur. The combination of the above factors makes it extremely difficult to fully fund the private equity class over the short-term. Given the above issues, PCA has recommended to its clients that, once a long-term policy for private equity is determined, the plan sponsor set interim policy targets that are more reasonable to achieve over the short and intermediate terms. Differences between the long-term and interim private equity targets should be allocated across the public market asset classes on a pro rata basis to reduce overall tracking error to policy. The time frame for reaching long-term private equity policy for a large-scale program should be expected to occur in no less than five years.

Institutional Usage

73. In 2006, the 200 largest defined benefit plans in the United States had allocated approximately 4.1%, or $137.5 billion, of total assets to private equity-oriented mandates.[45] According to Greenwich, a leading researcher of international institutional investment trends, as of yearend 2005, all U.S. pension funds had allocated approximately $212 billion to real estate.[46]

[45] Source: Pension & Investments, January 22, 2007.

[46] 2005 Market Report, Greenwich Associates, 2006.

ANNEX III

Pension Consulting Alliance/EFI Actuaries

PCA/EFI Asset Class Resampling Data Set Used in UNJSPF Study

March 2007

Asset Class Return Time Series Data Set Used in UNJSPF Study

Nominal Return Series

YEAR	SH TERM	GLBLFXD	EMD	UN_RE	REALRET	GLBLEQ	EMEQ	PRIV_EQ
1970	6.63%	12.79%	17.40%	-2.37%	14.00%	0.82%	6.65%	-36.18%
1971	4.41%	14.55%	25.45%	-0.97%	5.20%	18.18%	28.54%	1.79%
1972	4.14%	6.59%	18.80%	-2.20%	7.23%	22.59%	34.30%	10.00%
1973	7.25%	6.35%	6.76%	-5.51%	34.40%	-14.57%	-11.35%	-36.96%
1974	8.18%	7.23%	2.62%	-4.94%	22.30%	-25.37%	-22.22%	-32.37%
1975	6.01%	9.64%	31.44%	-3.03%	0.87%	35.36%	49.70%	36.30%
1976	5.12%	9.04%	24.51%	24.61%	12.77%	15.05%	25.38%	62.83%
1977	5.45%	19.32%	-29.06%	20.04%	22.67%	1.83%	8.04%	55.62%
1978	7.40%	15.15%	20.95%	24.19%	15.97%	18.20%	27.36%	63.81%
1979	10.35%	1.18%	10.88%	36.43%	22.37%	11.85%	21.42%	35.31%
1980	11.88%	7.03%	-20.00%	27.25%	3.33%	26.99%	38.08%	96.79%
1981	15.04%	-0.57%	-13.74%	23.54%	7.20%	-3.17%	3.07%	-9.34%
1982	11.33%	22.38%	-12.63%	20.42%	14.02%	10.83%	19.82%	27.39%
1983	8.95%	5.42%	72.28%	24.45%	-1.20%	23.57%	33.41%	43.70%
1984	10.00%	10.21%	40.03%	21.92%	6.57%	6.11%	13.67%	-6.58%
1985	7.84%	28.65%	76.48%	19.64%	13.13%	42.26%	56.89%	8.99%
1986	6.23%	23.03%	47.51%	-1.22%	5.37%	42.88%	59.28%	0.90%
1987	5.90%	18.41%	-26.27%	-5.35%	15.30%	16.85%	25.96%	2.85%
1988	6.76%	4.37%	-4.78%	-2.10%	13.23%	24.32%	40.44%	9.26%
1989	8.64%	4.34%	-14.71%	-3.75%	21.87%	17.17%	64.97%	4.50%
1990	7.90%	11.22%	38.35%	-9.11%	14.77%	-16.36%	-10.56%	-4.19%
1991	5.75%	16.04%	38.80%	-12.46%	6.39%	19.28%	59.92%	22.36%
1992	3.61%	5.80%	6.98%	-11.60%	14.55%	-4.43%	11.41%	14.02%
1993	3.07%	11.08%	44.17%	-6.41%	13.49%	23.11%	74.86%	28.46%
1994	4.22%	0.23%	-19.28%	-4.08%	3.71%	5.65%	-7.31%	7.41%
1995	5.74%	19.66%	27.34%	-1.56%	15.26%	21.50%	-5.18%	17.38%
1996	5.25%	4.91%	37.75%	21.22%	11.09%	14.10%	6.04%	38.15%
1997	5.24%	3.79%	10.81%	23.22%	8.66%	16.07%	-11.58%	31.34%
1998	5.31%	13.71%	-8.11%	20.28%	0.44%	24.76%	-27.52%	25.00%
1999	4.74%	-5.17%	19.56%	-0.41%	13.31%	25.26%	66.41%	100.42%
2000	6.16%	3.18%	12.68%	21.38%	9.61%	-12.99%	-31.80%	-33.70%
2001	3.64%	1.57%	9.70%	-2.49%	-3.62%	-16.53%	-2.40%	-29.50%
2002	1.80%	16.53%	13.65%	-3.80%	13.77%	-19.54%	-6.17%	-40.20%
2003	1.16%	12.51%	22.21%	18.83%	15.12%	33.77%	51.60%	67.00%
2004	1.44%	9.27%	11.62%	24.30%	11.28%	15.24%	25.95%	19.60%
2005	3.35%	-4.49%	10.25%	26.98%	9.11%	10.02%	34.54%	5.00%
2006	4.80%	6.64%	9.86%	27.23%	7.95%	20.65%	32.17%	10.00%

Acronym	Asset Class	Data Source
SH TERM	Short-term	90-Day Tbills (Source PCA)
GLBLFXD	Global Fixed Income	1970-1985: Simulated per Bridgewater; 1986-1989: Citigroup WGBI; 1990-2006 Lehman Global Aggregate (Source PCA)
EMD	Emerging Market Fixed Income	1970-1975: modeled and simulated returns per PCA; 1976-1990: Simulated per Bridgewater, based on EM bank loans; 1991-1993: JP Morgan EMBI+ (Source UBS); 1994-2006 JP Morgan EMBIGD (Source PCA)
UN_RE	Real Estate	Combination of NCREIF + random allocation to NAREIT or WRE adjusted to unique UN asset class attributes (Source PCA)
REALRET	Real Return	Combination of Global TIPS, Timber, Commodities, Hedge FofF (Source PCA), based on modeled TIPS returns 1970-1996 (Source Bridgewater)
GLBLEQ	Global Equity	MSCI World Free (Source UBS AM)
EMEQ	EM Equity	1988-2006: MSCI Emerging Markets Free (Source PCA); modeled and simulated returns 1970-1987 (Source PCA)
PRIV_EQ	Private Equity	Combination of Brinson and PVCI Index (Source PCA)

ANNEX IV

Pension Consulting Alliance/EFI Actuaries

Tests of Currency Hedging

March 2007

Tests of Currency Hedging

1. One important task of the asset-liability project was to determine whether hedging out currency risk would enhance the projected risk-adjusted financial performance of the UNJSPF Plan. Using the currency hedging framework described in Chapter V of this report, we found that currency hedging impacted neither policy allocations nor risk-adjusted financial performance. In fact, there is modest evidence that hedging currency may prove detrimental to the longer-term results of the Plan.

2. To determine the potential impact of currency hedging, we developed two separate optimization algorithms, with one utilizing unhedged asset classes and the other utilizing hedged asset classes, per the framework in Chapter V. Under this framework, approximately 90% of the UNJSPF investment portfolio was assumed to be hedged. At this level of hedging we would expect to see material differences in risk-adjusted performance, if any, versus no hedging at all. We then identified an optimal asset allocation policy (inclusive of all potential asset classes and using the allocation constraints discussed in Chapter V) for each of the eight Decision Factors utilized in the asset-liability modeling process. Each Decision Factor represents a unique potential view of risk tolerance. There are two objectives in this analysis: (i) determine whether currency hedging causes different optimal asset allocations and (ii) determine whether the unhedged and hedged asset allocation policies produce different simulated financial results for the overall UNJSPF Plan.

3. To accomplish the first objective, we produced optimal asset allocations for each of the eight Decision Factors using unhedged asset classes (see Pane A, next page). Next, we produced optimal asset allocations for each of the eight Decision Factors using hedged asset classes (see Panel B). Panel C shows the difference between the two sets of asset allocations policies. Panel C indicates that hedging currency does not materially impact the asset allocation policy decision, given the existing asset class constraints and the structure of the UNJSPF Plan, regardless of the risk tolerance selected.

Figure 1 – Comparisons of Asset Allocation Policies, Using Hedged and Unhedged Assets Class, By Decision Factor (i.e., risk tolerance level)

Panel A – Optimal Asset Allocation Policies, Unhedged Asset Classes, by Decision Factor

			Optimal Asset Allocation - %										
Risk Tolerance Philosophy	Factor Nbr	Weighting	Global Equity	EM Equity	Total Public Equity	Global Fixed	EM Fixed	Total Public Fixed	Real Estate	Priv Equity	Real Return	Short Term	Total
Neutral	All	Equal	47	7	**54**	30	0	**30**	7	3	3	3	**100**
Avoid High Cost	1	100%	47	3	**50**	32	4	**36**	7	1	3	3	**100**
Avoid Low Cost	2	100%	48	3	**51**	32	4	**36**	7	0	3	3	**100**
Seek High Ratio	3	100%	56	7	**63**	26	0	**26**	5	3	0	3	**100**
Avoid Low Ratio	4	100%	47	4	**51**	32	1	**33**	7	3	3	3	**100**
Seek High Real Return	5	100%	53	7	**60**	26	0	**26**	5	3	3	3	**100**
Avoid Negative Real Return	6	100%	47	7	**54**	26	4	**30**	7	3	3	3	**100**
Seek High Assets to Benefits	7	100%	56	7	**63**	26	0	**26**	5	3	0	3	**100**
Avoid Low Assets to Benefits	8	100%	47	5	**52**	32	0	**32**	7	3	3	3	**100**

Panel B – Optimal Asset Allocation Policies, Hedged Asset Classes, by Decision Factor

			Optimal Asset Allocation - %										
Risk Tolerance Philosophy	Factor Nbr	Weighting	Global Equity	EM Equity	Total Public Equity	Global Fixed	EM Fixed	Total Public Fixed	Real Estate	Priv Equity	Real Return	Short Term	Total
Neutral	All	Equal	47	7	**54**	30	0	**30**	7	3	3	3	**100**
Avoid High Cost	1	100%	47	3	**50**	32	4	**36**	7	1	3	3	**100**
Avoid Low Cost	2	100%	48	3	**51**	32	4	**36**	7	0	3	3	**100**
Seek High Ratio	3	100%	56	7	**63**	26	0	**26**	5	3	0	3	**100**
Avoid Low Ratio	4	100%	48	4	**52**	32	0	**32**	7	3	3	3	**100**
Seek High Real Return	5	100%	53	7	**60**	26	0	**26**	5	3	3	3	**100**
Avoid Negative Real Return	6	100%	47	7	**54**	26	4	**30**	7	3	3	3	**100**
Seek High Assets to Benefits	7	100%	56	7	**63**	26	0	**26**	5	3	0	3	**100**
Avoid Low Assets to Benefits	8	100%	47	5	**52**	32	0	**32**	7	3	3	3	**100**

Panel C – Differences Between Optimal Asset Allocation Policies (Panel B – Panel A), by Decision Factor

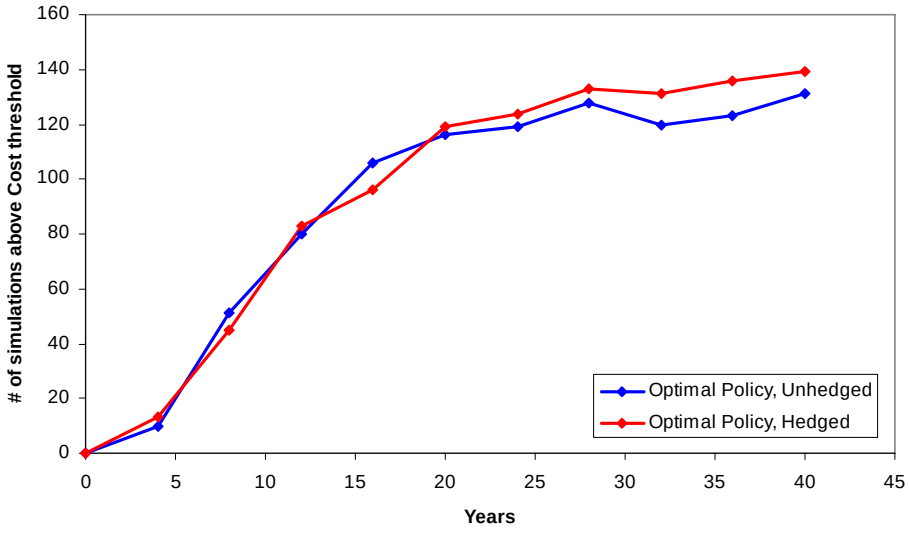
			Differences between Hedged and Unhedged Policies - %										
Risk Tolerance Philosophy	Factor Nbr	Weighting	Global Equity	EM Equity	Total Public Equity	Global Fixed	EM Fixed	Total Public Fixed	Real Estate	Priv Equity	Real Return	Short Term	Total
Neutral	All	Equal	0	0	**0**	0	0	**0**	0	0	0	0	**0**
Avoid High Cost	1	100%	0	0	**0**	0	0	**0**	0	0	0	0	**0**
Avoid Low Cost	2	100%	0	0	**0**	0	0	**0**	0	0	0	0	**0**
Seek High Ratio	3	100%	0	0	**0**	0	0	**0**	0	0	0	0	**0**
Avoid Low Ratio	4	100%	1	0	**1**	0	-1	**-1**	0	0	0	0	**0**
Seek High Real Return	5	100%	0	0	**0**	0	0	**0**	0	0	0	0	**0**
Avoid Negative Real Return	6	100%	0	0	**0**	0	0	**0**	0	0	0	0	**0**
Seek High Assets to Benefits	7	100%	0	0	**0**	0	0	**0**	0	0	0	0	**0**
Avoid Low Assets to Benefits	8	100%	0	0	**0**	0	0	**0**	0	0	0	0	**0**

4. Only under a risk tolerance that focuses on avoiding low funding ratios (Decision Factor 4) is there any difference in asset allocation policies, and even in that case the differences are not material.

5. While the asset allocation policies are virtually identical, one set of policies contains unhedged asset classes, while the other contains hedged asset classes. Do the contrasting sets of policies yield different simulated results of long-term Plan financial condition? To answer this question, we compared each of respective hedged and unhedged asset allocation policies, by Decision Factor. For each pair of policies we reviewed how they performed with respect to the performance of the underlying variable related to the

Decision Factor. For example, Decision Factor 1 (Avoid High Cost), selects an optimal policy based on its ability to keep employer costs below a specific annual threshold (23.7% of pay in the case of the UNJSPF). To determine how the unhedged policy performed versus the hedged policy we counted the number of times the simulated costs of the UNJSPF Plan exceeded the high-cost threshold over a 40-year horizon (see chart below).

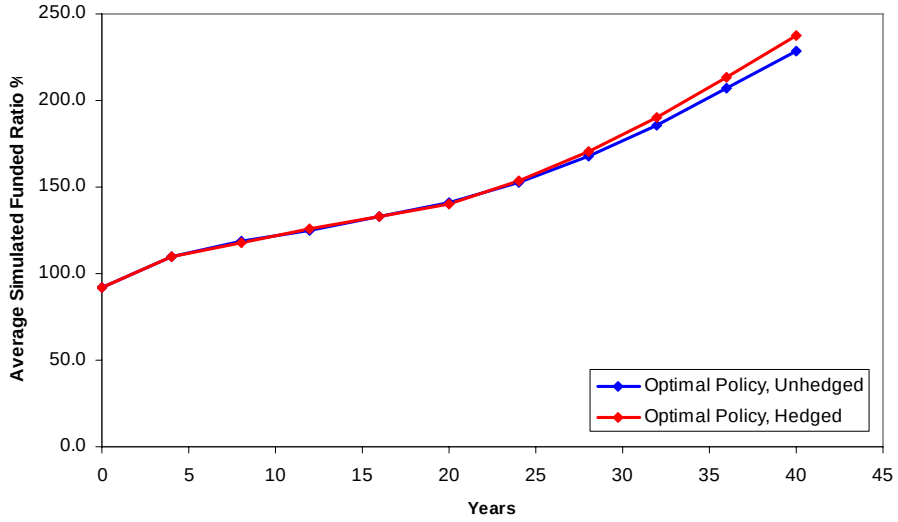
Figure 2 – Decision Factor 1 Optimal Policies, Comparison of Frequency of Simulated Annual Plan Costs Exceeding 23.7% Cost Threshold, Unhedged versus Hedged Policies (500 simulations)



6. The chart above indicates that for the first twenty years of simulations, there is virtually no difference between hedged and unhedged policies in how often plan costs exceed the threshold level. However, after twenty years, the unhedged policy portfolio produces marginally fewer instances of simulated costs exceeding the threshold level. From a risk tolerance perspective that focuses solely on managing cost volatility, the hedged policy portfolio underperforms.

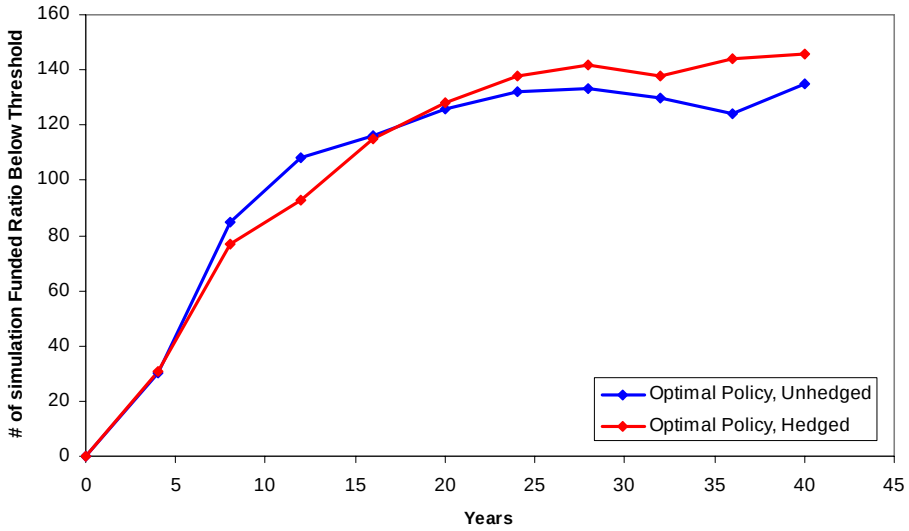
7. As another example, Decision Factor 3 (Seek High Funding) selects an optimal policy based on its ability to produce a high funded ratio over time. To determine how the unhedged policy performed versus the hedged policy we tracked the average simulated funded ratio over a 40-year horizon (see chart next page).

Figure 3 – Decision Factor 3 Optimal Policies, Comparison of Average of Simulated Funded Ratios, Unhedged versus Hedged Policies (500 simulations)



8. As the chart above shows, there is virtually no difference in simulated funded ratio outcomes between hedged and unhedged policies for the next 30 years. Out beyond thirty years, the average funded ratio of the hedged policy is modestly greater than that of the unhedged policy. However, this projected trend must be assessed against the potential volatility of the funded ratio (see chart below).

Figure 4 – Decision Factor 4 Optimal Policies, Comparison of Frequency of Simulated Funded Ratio Falling Below 85% Threshold, Unhedged versus Hedged Policies (500 simulations)



9. The above chart indicates that, in contrast to the average funded ratio level trend, the potential for the funded ratio to fall below an acceptable lower bound is generally higher for the hedged policy than for the unhedged policy. This result appears to take effect after about 20 years when the gap in the frequency of underperformance between the two

policies widens dramatically. Across a more intermediate horizon, the simulated hedged policy portfolio fell below the threshold less often, but the gap was not as significant as in later years.

10. The above examples highlight that, when all asset classes are considered, it is extremely difficult to determine whether hedging an asset allocation policy against currency fluctuations exhibits any material impact upon overall Plan financial performance. In fact, across all eight Decision Factors, there were four instances where the unhedged policy marginally outperformed and only one instance where the hedged policy produced what could be interpreted as a relatively favorable outcome. The other three instances produced results that were indistinguishable between hedged and unhedged policies.

Analysis of Currency Hedging Impact Using Only Current Asset Classes

11. We also examined the impact of currency hedging on optimal policies derived from using the UNJSPF's existing set of asset classes (including an allowance for the emerging markets segments). The general finding that currency hedging did not add material value remains but, in contrast to developing optimal allocation policies using all asset classes, there were circumstances where hedged allocations varied materially from unhedged allocations.

12. We examined the optimal asset allocations, using only those asset classes currently utilized by the UNJSPF (i.e., excluding Private Equity and Real Return classes, but allowing for exposure to emerging market segments), under each of the three risk tolerance philosophies on both an unhedged and hedged basis (see chart below).

Figure 5 – Comparisons of Asset Allocation Policies, Using Hedged and Unhedged Asset Classes, By Risk Philosophy (using only existing UNJSPF asset classes)

Panel A – Optimal Asset Allocation Policies, Unhedged Asset Classes, by Risk Philosophy

	Optimal Asset Allocation - %										
Risk Tolerance Philosophy	**Global Equity**	**EM Equity**	**Total Public Equity**	**Global Fixed**	**EM Fixed**	**Total Public Fixed**	**Real Estate**	**Priv Equity**	**Real Return**	**Short Term**	**Total**
Prudent Funding	57	7	**64**	26	0	**26**	7	0	0	3	**100**
Return-Oriented	55	6	**61**	29	0	**29**	7	0	0	3	**100**
Defensive	54	3	**57**	32	1	**33**	7	0	0	3	**100**

Panel B – Optimal Asset Allocation Policies, Hedged Asset Classes, by Risk Philosophy

	Optimal Asset Allocation - %										
Risk Tolerance Philosophy	**Global Equity**	**EM Equity**	**Total Public Equity**	**Global Fixed**	**EM Fixed**	**Total Public Fixed**	**Real Estate**	**Priv Equity**	**Real Return**	**Short Term**	**Total**
Prudent Funding	58	7	**65**	26	0	**26**	6	0	0	3	**100**
Return-Oriented	59	5	**64**	26	0	**26**	7	0	0	3	**100**
Defensive	49	5	**54**	32	4	**36**	7	0	0	3	**100**

Panel C – Differences Between Optimal Asset Allocation Policies (Panel B – Panel A), by Risk Philosophy

	Differences Between Hedged and Unhedged Policies - %										
Risk Tolerance Philosophy	**Global Equity**	**EM Equity**	**Total Public Equity**	**Global Fixed**	**EM Fixed**	**Total Public Fixed**	**Real Estate**	**Priv Equity**	**Real Return**	**Short Term**	**Total**
Prudent Funding	1	0	**1**	0	0	**0**	-1	0	0	0	**0**
Return-Oriented	4	-1	**3**	-3	0	**-3**	0	0	0	0	**0**
Defensive	-5	2	**-3**	0	3	**3**	0	0	0	0	**0**

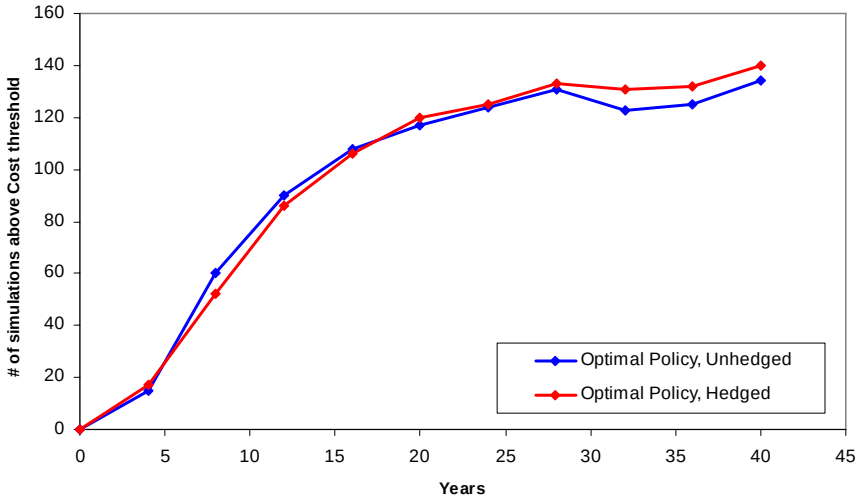
13. As the chart above indicates, under the Prudent Funding risk tolerance philosophy, there is no material difference between the hedged and unhedged optimal asset allocation policies. Under the two other risk tolerance philosophies, however, there are significant differences between the optimal hedged and unhedged policies. Such differences signal that a strategic currency hedging strategy could alter the risk-adjusted financial performance of the overall UNJSPF Plan.

14. To test the impact of currency hedging on these specific optimal policies, we again analyzed the simulated financial performance behavior of specific Plan attributes for the unhedged and hedged optimal policies, similar to our analysis of optimal policy outcomes in the first section of this Annex. In summary, across eleven key risk attributes utilized under the three risk philosophies, five risk attributes exhibited marginally unfavorable results when a hedged policy was utilized, five risk attributes exhibited similar results under a hedged policy, and one attribute exhibited marginally favorable results under a hedged policy. These findings again indicate that strategic currency hedging is not a value-added exercise even if the UNJSPF elects to utilize only its existing set of asset classes.

15. As an example, under the Return Oriented risk tolerance philosophy, there is virtually no difference in the average annual real return the UNJSPF portfolio is expected to produce. Under the optimal policy utilizing unhedged asset classes, the expected average annual real return is 5.0%. Under the optimal policy utilizing hedged asset classes, the expected average annual real return is 4.9%. The return difference is too small to be distinguishable.

16. Under the Return Oriented philosophy simulated Overall Plan risk does not improve utilizing hedged asset classes. For example, the projected trend in the volatility of Plan costs is, again, very similar across the hedged and unhedged policies (see chart below).

Figure 6 – Optimal Policies, Comparison of Frequency of Simulated Annual Plan Costs Exceeding 23.7% Cost Threshold, Unhedged versus Hedged Policies (500 simulations)

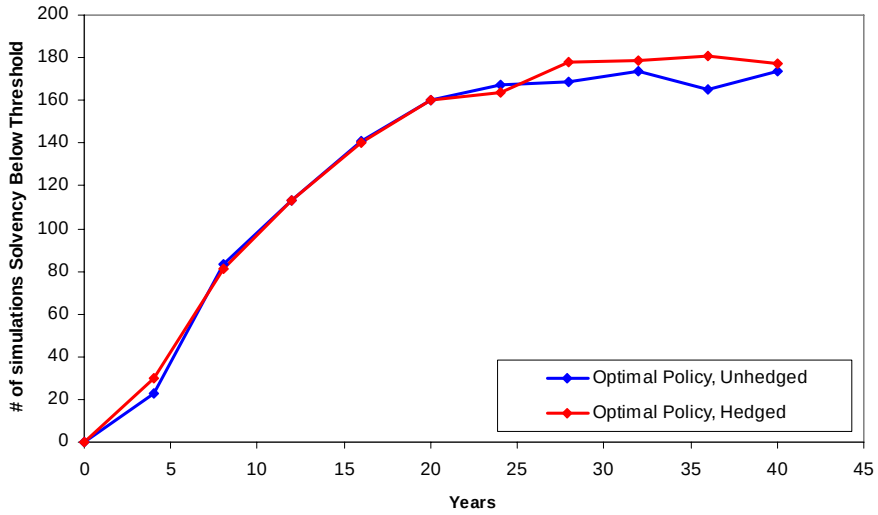


17. The chart above indicates that there is no projected difference in cost volatility between the hedged and unhedged policies for the initial 25 year horizon. In fact, after

about 30 years, the policy utilizing hedged asset classes begins to exhibit marginally higher cost volatility.

18. Similar findings occur when simulating projected Plan solvency (see chart below):

Figure 7 – Optimal Policies, Comparison of Frequency of Simulated Assets Falling Below 15X Annual Benefits, Unhedged versus Hedged Policies (500 simulations)



19. Similar to projected cost volatility, there is virtually no distinction in solvency performance between the unhedged and hedged policies for the first 25 years. After about 30 years, the hedged policy exhibits a modestly higher potential of insolvency than the policy mix using unhedged asset classes.

20. Similar results occurred under the other two risk tolerance philosophies (Prudent Funding and Defensive). These findings substantiate the conclusion that, even under a policy utilizing only existing UNJSPF asset classes, currency hedging would not prove beneficial to the future financial performance of the overall UNJSPF Pension Plan.

21. The above results indicate that there is virtually no material positive impact from a passive currency hedging strategy. Based on these findings, PCA/EFI and the Steering Committee concluded that a passive currency hedging strategy would not add risk-adjusted value to overall Plan financial performance.

ANNEX V

Pension Consulting Alliance/EFI Actuaries

Mean-Variance Statistics, Various Recommended Policies

March 2007

Comparative Asset Allocation and Return and Risk Statistics
Various Policy Recommendations

	Prudent Funding		Return Oriented		Defensive	
	Current Clases	All Classes	Current Clases	All Classes	Current Clases	All Classes
Asset Class (in %)						
Short-term	3	3	3	3	3	3
Global Dev Fixed	26	26	29	26	32	32
EM Fixed	0	0	0	0	1	2
UN Real Estate	7	7	7	5	7	7
Real Return	0	3	0	3	0	3
Global Dev Eq	57	51	55	53	54	47
EM Equity	7	7	6	7	3	3
Private Equity	0	3	0	3	0	3
Total	*100*	*100*	*100*	*100*	*100*	*100*
Return/Risk Statistics						
Expected Annual Return	7.9	8.0	7.8	8.0	7.6	7.7
Expected 1-Yr SD	10.5	10.4	10.1	10.6	9.5	9.2
Expected 10-Yr SD	3.3	3.3	3.2	3.3	3.0	2.9

ANNEX VI

Pension Consulting Alliance/EFI Actuaries

Glossary of Terms

March 2007

Glossary of Terms

Terms defined in this glossary are defined for quick reference and convenience. Definitions or benefits described in this glossary do not supersede the meaning of terms of the benefits as they are used and defined in plan documents or in other documents.

Actuarial Accrued Liability
Total accumulated cost to fund pension benefits arising from service in all prior years.

Actuarial Cost Method
Technique used to assign or allocate, in a systematic and consistent manner, the expected cost of a pension plan for a group of participants to the years of service that give rise to that cost.

Actuarial Present Value of Future Benefits
Amount that, together with future interest, is expected to be sufficient to pay all future benefits.

Actuarial Valuation
Study of probable amounts of future pension benefits and the necessary amount of contributions to fund those benefits.

Actuarial Value of Assets
The value of assets considered in the actuarial valuation of a pension plan and used to determine the required annual contribution and funded ratio. (is not equal to market value when smoothing methodology is used)

Actuary
Person who performs mathematical calculations pertaining to pension and insurance benefits based on specific procedures and assumptions.

Asset Allocation Policy
A target investment portfolio consisting of proportional allocations to asset classes (see below). An asset allocation policy requires that, over time, the pension plan's actual portfolio maintain the proportional allocations to the included asset classes.

Asset Class
A major segment of the investment markets (e.g., domestic equities, fixed income, international equity, private equity, etc.). Each asset class typically has unique investment return and risk characteristics. An investment portfolio's long-term (i.e., strategic) allocation to various asset classes has the most influence over the variability of an investment portfolio's investment performance over time.

Asset Class Benchmark
A broadly diversified portfolio of passively held securities that represents the investment opportunity set associated with a specific asset class. Asset class benchmarks are typically indices that are published by widely recognized providers that have developed systematic approaches to defining the appropriate opportunity set.

Asset Class Assumptions
Expected average annual returns, risks (volatilities) for each asset class, and correlations among/across all asset classes. These assumptions are derived typically through both a statistical analysis of asset class history and forward-looking fundamental analyses. The assumptions are not meant to be used for tactical purposes, but rather reflect the long-term, consensus expectations for each asset class.

Asset-Liability Study
An analysis of a pension plan that includes forward-looking projections for both the plan's assets and its liabilities. Asset-liability studies are utilized to test and analyze how investment portfolios containing different allocations of

assets might impact the future financial condition of the pension plan. One outcome of an asset-liability study could be a change in the asset allocation policy for the pension plan's investment portfolio.

Annual Required Contribution
Disclosure measure of annual pension cost.

Cost-Of-Living Adjustment (COLA)
A COLA may begin once the retired member has been receiving retirement benefits. It represents an adjustment to account for the loss of purchasing power associated with general inflation.

Currency Hedging
A process used (typically applying derivative instruments) to isolate and limit the risks associated with the movement of one currency versus other currencies. If liabilities are denominated in one currency and investments are denominated in other currencies, then the movement of those other currencies may present additional risks to funding the liabilities. Hedging out currency fluctuations from the investment portfolio, to some degree, may help reduce the commensurate risk associated with funding liabilities. For the sake of this study, an analysis of hedging out US $ currency risk was undertaken.

Decision Factor
A specific quantitative measure of the pension fund that reflects the concerns and goals of the pension fund's decision makers. Examples of quantitative measures used in decision factors include: the funded level of a pension plan, the cost or contribution level of a plan, the volatility of the funded level, the volatility of costs or contributions, etc. Decision factors are framed in the form of a goal or a concern. For example, "Seek a funded ratio of X% by Year 20XX." Each pension plan is typically confronted with several possibly competing decision factors. Each portfolio is analyzed based on its ability meet each specific decision factor.

Decision Factor Weight
A percent amount (between 0% and 100%) assigned to each decision factor. The decision factor weights reflect a specific decision maker's priorities about the goals and risks of the plan. The weights provide a quantitative underpinning for selecting an ideal asset allocation policy for the pension plan

Defined Benefit (DB) Plan
DB Plans are traditional retirement plans. The plan promises a retirement benefit based on age and total years of service. The member gets a flat monthly benefit upon retirement. Under this type of plan, the employers make the contributions and FPPA (or the local plan) is entirely responsible for ensuring that assets are available to provide the pension that each member is promised. (Statewide Defined Benefit Plan, Old Hires, and Exempt Plans are DB Plans.)

Efficient Frontier
A set of optimal portfolios at varying degrees of risk. In mean-variance space, an efficient frontier is that set of portfolios that maximize investment return at each level of investment risk. (or minimizes investment risk at each level of expected return). In more generalized terms, an efficient frontier is that set of portfolios that maximizes the ability to meet a certain objective while minimizing the risk of achieving that objective.

Normal Cost
That portion of the actuarial present value of benefits assigned to a particular year in respect to an individual participant or the plan as a whole.

Optimal Portfolio
A portfolio that best meets the decision makers' objectives while minimizing the risk associated with meeting those objectives. In a mean-variance context, the objective is to maximize return while minimizing the risk of achieving that return. In this sense, a mean-variance optimal portfolio is single dimensional in that it only focuses one variable investment return. A more generalized approach is to include other plan-oriented variables into the objective setting process. The PCA/EFI process use a multi-variable approach to identifying optimal portfolios, where maximizing risk-adjusted returns is a single, special case.

Resampling
A specific form of simulation (see below) that gathers historical samples of data and then randomly selects from that data to create potential scenarios. If performed over hundreds, if not thousands, of randomly selected scenarios, resampling can provide a very likely range of future outcomes.

Resampling Data Set
The resampling process does not rely explicitly on mean-variance asset class assumptions to develop simulated asset class return patterns. Rather, a historical dataset is used for sampling purposes. For the UNJSPF study, the dataset ranged from 1970 to 2006 for all asset classes. Individual asset class return samples were adjusted to conform with asset class assumptions developed under the mean-variance framework.

Risk Tolerance Philosophy
Determining one's tolerance for risk is one of the most important, but most difficult procedures in asset allocation modeling. Risk tolerance is critical because it determines where on the efficient frontier (see above) to select an optimal portfolio (see above). The PCA/EFI system precisely quantifies risk tolerance by relating financial attributes of the pension plan to the decision makers' sensitivities around those attributes. This process allows decision makers to intuitively develop characterize their tolerance for risk.

Simulation
A process that analyzes how a participant in an experiment will behave across numerous scenarios. In an asset - liability study, the participant is the pension fund and the pension fund's investment portfolio. Numerous economic and investment market-related scenarios are simulated to determine how the pension fund might behave over a multiple year time horizon.

Two-track feature of the Pension Adjustment System
A system that allows UNJSPF retiree members to adjust their benefits to increase at the better of (i) their value in US$, or (ii) their value in local currency.

Unfunded Actuarial Accrued Liability
The portion of the actuarial accrued liability not offset by plan assets.