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Iowa Public Employees' Retirement System

Economic Assumptions Study

March 24, 2017

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March 24, 2017

Investment Board
Iowa Public Employees' Retirement System
7401 Register Drive
Des Moines, IA 50321

Dear Members of the Board:

It is our pleasure to submit this report of our analysis of the economic assumptions for the Iowa Public Employees' Retirement System. The results of the experience study are the basis for recommended changes in the actuarial assumptions, which if adopted by the Board, will be first be used for the June 30, 2017 actuarial valuation. With the Board's approval of the recommendations in the report, we believe the actuarial condition of the System will be more accurately portrayed.

We hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board (ASB) and the Code of Professional Conduct and Qualification Standards for Public Statements of Actuarial Opinion of the American Academy of Actuaries.

We further certify that the assumptions developed in this report satisfy ASB Standards of Practice, in particular, No. 27 (Selection of Economic Assumptions for Measuring Pension Obligations).

We would like to acknowledge the help in the preparation of the data for this investigation given by the IPERS staff and Wilshire Consulting.

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I, Patrice A. Beckham, F.S.A., am a member of the American Academy of Actuaries and a Fellow of the Society of Actuaries, and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

I, Brent A. Banister, F.S.A., am a member of the American Academy of Actuaries and a Fellow of the Society of Actuaries, and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Sincerely,

Patrice Beckham

Patrice A. Beckham, FSA, EA, FCA, MAAA
Principal and Consulting Actuary

Brent A. Banister

Brent A. Banister, PhD, FSA, EA, FCA, MAAA
Chief Pension Actuary

SECTION 1 – BOARD SUMMARY

Introduction

The purpose of an actuarial valuation is to provide a timely best estimate of the ultimate costs of a retirement system. Actuarial valuations of IPERS are prepared annually to determine the employer contribution rate required to fund the System on an actuarial reserve basis, i.e. the current assets plus future contributions, along with investment earnings will be sufficient to provide the benefits promised by the System. The valuation requires the use of certain assumptions with respect to the occurrence of future events, such as rates of death, termination of employment, retirement age, and salary changes to estimate the obligations of the System.

The basic purpose of an experience study is to determine whether the actuarial assumptions currently in use have adequately projected actual emerging experience. This information, along with the professional judgment of System personnel and advisors, is used to evaluate the appropriateness of continued use of the current actuarial assumptions. When analyzing experience and assumptions, it is important to recognize that actual experience is reported short term while assumptions are intended to be long term estimates of experience.

Although the next scheduled experience study is not scheduled until 2018, at the request of the Investment Board, the study of economic assumptions for the Iowa Public Employees Retirement System (IPERS) was accelerated to the spring of 2017. This report, prepared by Cavanaugh Macdonald Consulting, LLC (CMC), presents the results of our analysis and recommendations of changes to the economic assumptions. If approved by the Investment Board, the changes will be implemented in the June 30, 2017 actuarial valuation of the System.

These assumptions have been developed in accordance with generally recognized and accepted actuarial principles and practices that are consistent with the applicable Standards of Practice adopted by the Actuarial Standards Board (ASB). While the recommended assumptions represent our best estimate of future experience, there are other reasonable assumption sets that could be supported by the results of this experience study. Those other sets of reasonable assumptions could produce liabilities and costs that are either higher or lower.

Our Philosophy

Similar to an actuarial valuation, the calculation of actual and expected experience is a fairly mechanical process. From one actuary to another, you would expect to see very little difference. However, the setting of assumptions is a different story, as it is more art than science. In this report, we have recommended changes to certain assumptions. To allow you to better understand our thought process, we offer a brief summary of our philosophy:

- **Don't Overreact**: When we see significant changes in experience, we generally do not adjust our rates to reflect the entire difference. We will typically recommend rates somewhere between the old rates and the new experience. If the experience during the next study period shows the same result, we will probably recognize the trend at that point in time or at least move further in the direction of the observed experience. On the other hand, if experience returns closer to its prior level, we will not have overreacted, possibly causing volatility in the actuarial contribution rates.

- **Credibility:** Generally, there is insufficient data for any one single study period to be assigned full credibility in setting assumptions. Actual experience is analyzed to determine whether it is likely a long-term trend or an anomaly. If we determine the experience is credible, we move part way to the observed experience but not all the way.

- **Anticipate Trends**: If there is an identified trend that is expected to continue, we believe that this should be recognized. An example is the retiree mortality assumption. It is an established trend that people are living longer. Therefore, we believe the best estimate of liabilities in the valuation should reflect the expected increase in life expectancy.

- **Simplify**: In general, we attempt to identify which factors are significant and eliminate or ignore the ones that do not materially improve the accuracy of the liability projections.

Summary of Recommendations – Economic Assumptions

The following table summarizes the current and proposed economic assumptions:

	Current Assumptions	Proposed Assumptions
Price Inflation	3.00%	2.60%
Investment Return	7.50%	7.00%
Interest on Member Accounts	3.75%	3.50%
Wage Growth	4.00%	3.25%
Payroll Growth	4.00%	3.25%

As the table indicates, our recommendation is to lower price inflation from 3.00% to 2.60%, based on the available data we reviewed. Since the price inflation assumption is also a component of the investment return assumption and the general wage growth assumption, changes to those assumptions are also being recommended. Based on the decrease in price inflation, we are recommending the investment return assumption be lowered to 7.00%. The recommendation for the wage growth assumption was lowered from 4.00% (price inflation of 3.00% + 1.00% productivity) to 3.25% (price inflation of 2.60% + 0.65% productivity). There are other sets of economic assumptions that could be considered reasonable and which would still meet actuarial standards of practice, if the Board is interested in considering other options.

Although not a major economic assumption, our analysis included the interest crediting rate for member account balances. As a result of our analysis, we recommend the rate be lowered from 3.75% to 3.50%.

Amortization payments on the unfunded actuarial liability (UAL) are developed as a level percent of payroll. Therefore, the valuation requires an assumption regarding future annual increases in covered

payroll. We recommend the payroll growth assumption, used to amortize the UAL, be lowered from 4.00% to 3.25%.

Financial Impact

The IPERS actuarial amortization method states that any change in actuarial liability arising from such events as changes in assumptions and methods or benefit design is to be amortized over a demographically appropriate time period selected by the Investment Board. The investment return assumption has a very long term impact. As a result, it is appropriate to consider a longer amortization period for changes to the investment return assumption compared to that used for gains/losses. Given that annual gains and losses are amortized over 20 years, it seems reasonable to amortize the impact of a change in long-term assumptions over at least the same 20-year period. The Conference of Consulting Actuaries has prepared a white paper on pension funding policy in which it recommended that such changes be amortized over 15 to 25 years, but it also recognizes that longer periods could be used.

Given these considerations, we would suggest that the Investment Board consider selecting an amortization period between 20 and 30 years for changes in long-term assumptions. We have prepared cost estimates reflecting the amortization of the increase in the unfunded actuarial liability due to the assumption changes over both 20 and 30 years. Selection of a period between those two would result in cost estimates somewhere between the cost results using 20 and 30 year amortization periods (but not in a linearly proportionate manner). One option would be to match the amortization period to that of the current legacy base (27 years as of the June 30, 2017 valuation when it is anticipated these assumption changes will be implemented).

The financial impact of the suggested changes was estimated by performing additional valuations with the June 30, 2016 valuation data. The cost impact, illustrated in the following tables, is based on the June 30, 2016 valuation using the recommended set of assumptions outlined in this report. The first exhibit shows the cost impact if the increase in the UAL is amortized over 30 years and the second exhibit reflects the amortization of the increase in the UAL over 20 years. Both exhibits reflect the calculation of the required contribution rate in the 2016 valuation as if the contribution rate would be applicable July 1, 2017.

When these assumptions are used in the June 30, 2017 valuation, we expect the relative impact to be similar to the results shown here (as a percentage of the actuarial liability and normal cost). However, the actual impact may vary due to underlying changes in the membership between valuation dates.

Cost Impact of All Economic Assumption Changes
7.00% Investment Return Assumption
Amortization of UAL Increase Over 30 Years

	Regular		Sheriffs/Deputies		Protection Occupation	
	Before	After	Before	After	Before	After
Actuarial Liability (millions)	$32,578	$33,884	$625	$650	$1,417	$1,471
Actuarial Value of Assets (millions)	$27,001	$27,001	$602	$602	$1,430	$1,430
Unfunded Actuarial Liability (millions)	$ 5,576	$ 6,883	$ 23	$ 48	($13)	$ 41
Funded Ratio	82.9%	79.7%	96.4%	92.6%	100.9%	97.2%
Normal Cost Rate	10.20%	10.42%	16.41%	16.82%	15.99%	16.37%
UAL Amortization Rate	4.01%	5.19%*	0.91%	2.30%*	0.00%	0.66%*
Actuarial Contribution	14.21%	15.61%	17.32%	19.12%	15.99%	17.03%
Required Contribution Rate	14.88%	15.61%	18.76%	19.26%	16.40%	17.03%
Employer Contribution Rate	8.93%	9.37%	9.38%	9.63%	9.84%	10.22%
Employee Contribution Rate	5.95%	6.24%	9.38%	9.63%	6.56%	6.81%

Note: Comparisons are based on the 6/30/16 valuation results. Actual results using the 6/30/17 valuation may vary from those shown here.

*** Results based on 30-year amortization of the increase in UAL due to the assumption change.**

Numbers may not add due to rounding.

Cost Impact of All Economic Assumption Changes
7.00% Investment Return Assumption
Amortization of UAL Increase Over 20 Years

	Regular		Sheriffs/Deputies		Protection Occupation	
	Before	After	Before	After	Before	After
Actuarial Liability (millions)	$32,578	$33,884	$625	$650	$1,417	$1,471
Actuarial Value of Assets (millions)	$27,001	$27,001	$602	$602	$1,430	$1,430
Unfunded Actuarial Liability (millions)	$ 5,576	$ 6,883	$ 23	$ 48	($13)	$ 41
Funded Ratio	82.9%	79.7%	96.4%	92.6%	100.9%	97.2%
Normal Cost Rate	10.20%	10.42%	16.41%	16.82%	15.99%	16.37%
UAL Amortization Rate	4.01%	5.48%*	0.91%	2.68%*	0.00%	0.85%*
Actuarial Contribution	14.21%	15.90%	17.32%	19.50%	15.99%	17.22%
Required Contribution Rate	14.88%	15.88%	18.76%	19.50%	16.40%	17.22%
Employer Contribution Rate	8.93%	9.53%	9.38%	9.75%	9.84%	10.33%
Employee Contribution Rate	5.95%	6.35%	9.38%	9.75%	6.56%	6.89%

Note: Comparisons are based on the 6/30/16 valuation results. Actual results using the 6/30/17 valuation may vary from those shown here.

*** Results based on 20-year amortization of the increase in UAL due to the assumption change.**

Numbers may not add due to rounding.

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SECTION 2 – ECONOMIC ASSUMPTIONS

The economic assumptions for IPERS include price inflation, long-term investment return, interest crediting rate for member accounts, wage growth (the across-the-board portion of salary increases) and the covered payroll increase assumption. Unlike demographic assumptions, economic assumptions do not lend themselves to analysis largely on the basis of internal historical patterns because economic assumptions are impacted by external forces in the economy. The investment return and general wage increase assumptions are selected on the basis of expectations in an inflation-free environment and then increased by the long-term expectation for inflation, called the "building block" approach.

Sources of data considered in the analysis and selection of the economic assumptions included:

- The 2016 Social Security Trustees Report
- Future expectations of IPERS investment consultant, Wilshire Consulting
- Future expectations of other investment consultants (2016 Horizon Survey)
- U.S. Department of the Treasury bond rates
- Assumptions used by other large public retirement systems, based on the Public Fund Survey, published by the National Association of State Retirement Administrators (NASRA)
- Historical observations of price and wage growth statistics and investment returns

Actuarial Standard of Practice Number 27

Guidance regarding the selection of economic assumptions for measuring pension obligations is provided by Actuarial Standard of Practice (ASOP) No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*. Because no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment.

ASOP 27 requires the actuary to select a "reasonable" assumption. For this purpose, an assumption is reasonable if it has the following characteristics:

a. it is appropriate for the purpose of the measurement;

b. it reflects the actuary's professional judgment;

c. it takes into account historical and current economic data that is relevant as of the measurement date;

d. it reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and

e. it has no significant bias (i.e., it is neither significantly optimistic nor pessimistic) except when provisions for adverse deviation or plan provisions that are difficult to measure are included.

With respect to relevant data, the standard recommends the actuary review appropriate recent and long-term historical economic data, but advises the actuary not to give undue weight to recent experience. Furthermore, it advises the actuary to consider that some historical economic data may not be appropriate for use in developing assumptions for future periods due to changes in the underlying environment. In addition, with respect to any particular valuation, each economic assumption should be consistent with all other economic assumptions over the measurement period.

SECTION 2 – ECONOMIC ASSUMPTIONS

ASOP 27 recognizes that economic data and analyses are available from a variety of sources, including representatives of the plan sponsor, investment advisors, economists, and other professionals. The actuary is permitted to incorporate the views of experts, but the selection or advice must reflect the actuary's professional judgment.

The standard also discusses a "range of reasonable assumptions" which in part states "the actuary should also recognize that different actuaries will apply professional judgment and may choose different reasonable assumptions." As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice.

The remaining section of this report will address the relevant types of economic assumptions used in the actuarial valuation to determine the obligations of the System. In our opinion, the economic assumptions proposed in this report have been developed in accordance with ASOP No. 27.

The following table summarizes the current and proposed economic assumptions:

	Current Assumptions	Proposed Assumptions
Price Inflation	3.00%	2.60%
Investment Return	7.50%	7.00%
Interest on Member Accounts	3.75%	3.50%
General Wage Growth	4.00%	3.25%
Payroll Growth	4.00%	3.25%

Price Inflation

Use in the Valuation: Future price inflation has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return, general wage growth (which then impacts individual salary increases), and payroll growth.

Inflation also has a direct impact on the valuation results. The Iowa Code provides for a potential increase in the annual dividend for members who retired before July 1990. The maximum annual increase in the dividend is the lesser of 3.0% or the increase in the CPI-U, subject to certain certifications by the actuary. Therefore, the inflation assumption is used directly to develop the assumed increase in the annual dividend payments for this group of retirees. The law also provides that the interest rate credited on member contribution balances will be 1% above the rate credited on a one year Certificate of Deposit (CD). Because the interest rate on a one year CD is dependent on inflation, the inflation assumption also impacts the assumed rate of interest on member account balances.

SECTION 2 – ECONOMIC ASSUMPTIONS

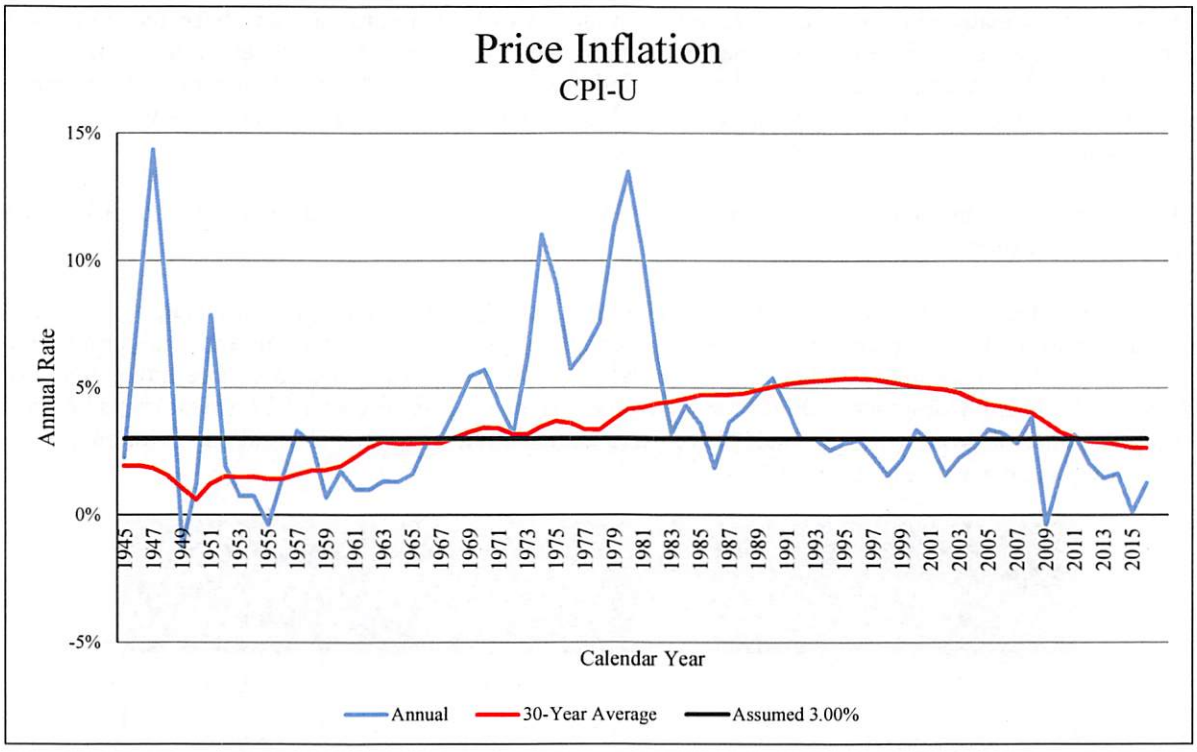
The long-term relationship between price inflation and investment return has long been recognized by economists. The basic principle is that the investor demands a more or less level "real return" – the excess of actual investment return over price inflation. If inflation rates are expected to be high, investment return rates are also expected to be high, while low inflation rates are expected to result in lower expected investment returns, at least in the long run.

The current assumption for price inflation is 3.00% per year which was recommended and adopted in the last experience study.

Past Experience: Although economic activities, in general, and inflation in particular, do not lend themselves to prediction solely on the basis of historical analysis, historical patterns and long-term trends are factors to be considered in developing the inflation assumption. The Consumer Price Index, US City Average, All Urban Consumers, CPI (U), has been used as the basis for reviewing historical levels of price inflation. The following table provides historical annualized rates and annual standard deviations of the CPI-U over periods ending December 31st.

Period	Number of Years	Annualized Rate of Inflation	Annual Standard Deviation
1926 – 2016	90	2.94%	3.83%
1956 – 2016	60	3.70	2.75
1966 – 2016	50	4.09	2.82
1976 – 2016	40	3.66	2.77
1986 – 2016	30	2.65	1.22
1996 – 2016	20	2.15	1.04
2006 - 2016	10	1.76	1.29

The following graph illustrates the historical annual change in price inflation, measured as of December 31 for each of the last 70 years, as well as the thirty year rolling average.



Over more recent periods, measured from December 31, 2016, the average annual rate of increase in the CPI-U has been below the current assumption of 3.00%. The period of high inflation from 1973 to 1982 has a significant impact on the averages over periods which include these rates. It is difficult to ignore the steady decline in inflation shown in the data above.

Forecasts of Inflation

Additional information to consider in formulating this assumption is obtained from measuring the spread on Treasury Inflation Protected Securities (TIPS) and from the prevailing economic forecasts. The spread between the nominal yield on treasury securities (bonds) and the inflation indexed yield on TIPS of the same maturity is referred to as the "breakeven rate of inflation" and represents the bond market's expectation of inflation over the period to maturity. Current market prices as of December 2016 suggest that investors expect inflation to be around 2.1% over the next 30 years. The bond market expectations may be heavily influenced by the low interest rate environment created by the Federal Reserve Bank's manipulation of the bond market. Whether inflation returns to the higher rates observed historically remains to be seen.

IPERS' investment consultant, Wilshire, also has an inflation forecast in their capital market assumptions. Their short-term assumption (10 years) is 1.95% and their long-term assumption (30 years) is 2.33%.

Social Security Projections

Although many economists forecast lower inflation than the assumptions used by retirement systems, they are generally looking at a shorter time horizon (10 years) than is appropriate for a pension valuation. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the most recent report (May 2016), the projected average annual increase in the CPI over the next 75 years was estimated to be 2.6%, under the intermediate (best estimate) cost assumption. The range of price inflation used in the Social Security 75-year modeling, which includes a low and high cost scenario, in addition to the intermediate cost projection, was 2.0% to 3.2%.

Peer System Comparison

While we do not recommend the selection of any assumption based on what other systems use, it does provide another set of relevant information to consider. According to the Public Plan Database (a survey of over 150 state and local retirement systems maintained by a collaboration between the Center for Retirement Research at Boston College, the Center for State and Local Government Excellence, and the National Association of State Retirement Administrators) the average inflation assumption for statewide systems has been steadily declining. As of the most recent study, the most common assumption is 3.00%, which is consistent with IPERS' current assumption. However, the survey is based on valuations that are almost entirely from 2013 or 2014. Based on our experience we believe that further declines have occurred for many systems in the last two years.

Conclusion: The current inflation assumption is 3.0%, which was reduced by 0.25% in the last experience study. While actuarial standards caution against assigning too much weight to recent experience, multiple factors lead us to believe the current inflation assumption should be reduced. Actual inflation for the last 30-years has been 2.65%, the bond markets reflect an expectation of inflation well below 3.0%, the inflation assumption used by the Chief Actuary of the Social Security Administration in their 75-year projections is 2.6%, Wilshire's long-term inflation assumption is 2.33%, and the median long-term inflation assumption in the Horizon Actuarial Survey is 2.31%. Based on this information, **we recommend a reduction in the inflation assumption from 3.00% to 2.60%.**

Consumer Price Inflation	
Current Assumption	3.00%
Recommended Assumption	2.60%

RATE OF CREDITING INTEREST ON MEMBER CONTRIBUTION BALANCES

Use in the Valuation: Iowa law provides that the interest rate credited on member contribution balances will be 1% above the rate credited on a one year Certificate of Deposit (CD). Because this rate impacts the dollar amount available for refund and the number of guaranteed payments at retirement under Option 2, an assumption is needed to project future member contribution balances. Note that this is a minor assumption that has a very small impact on the valuation results.

The current assumption is 3.75% (3.00% inflation plus 0.75%). The interest rate credited on Certificates of Deposit is directly impacted by inflation. Rates on short-term CDs tend to be somewhat similar to the long-term inflation rate. A comparison of the last ten years shows that the interest rate credited has exceeded inflation by approximately 1.0% per year.

Year	Interest Rate Credited on Member Accounts	Actual Inflation	Difference
2007	5.79%	2.85%	2.94%
2008	5.33%	3.84%	1.49%
2009	3.61%	-0.36%	3.97%
2010	2.64%	1.64%	1.00%
2011	2.03%	3.16%	-1.13%
2012	1.34%	2.07%	-0.73%
2013	1.28%	1.46%	-0.18%
2014	1.65%	1.62%	0.03%
2015	1.99%	0.12%	1.87%
2016	2.12%	1.26%	0.86%
Average			1.01%

Recommendation: Based on the recommended decrease in the inflation assumption, we believe an assumption for the interest rate credited on contribution balances of 3.50% (if inflation is 2.60%) is reasonable.

Interest on Contribution Balances	
Current Assumption	3.75%
Recommended Assumption	3.50%

INVESTMENT RETURN

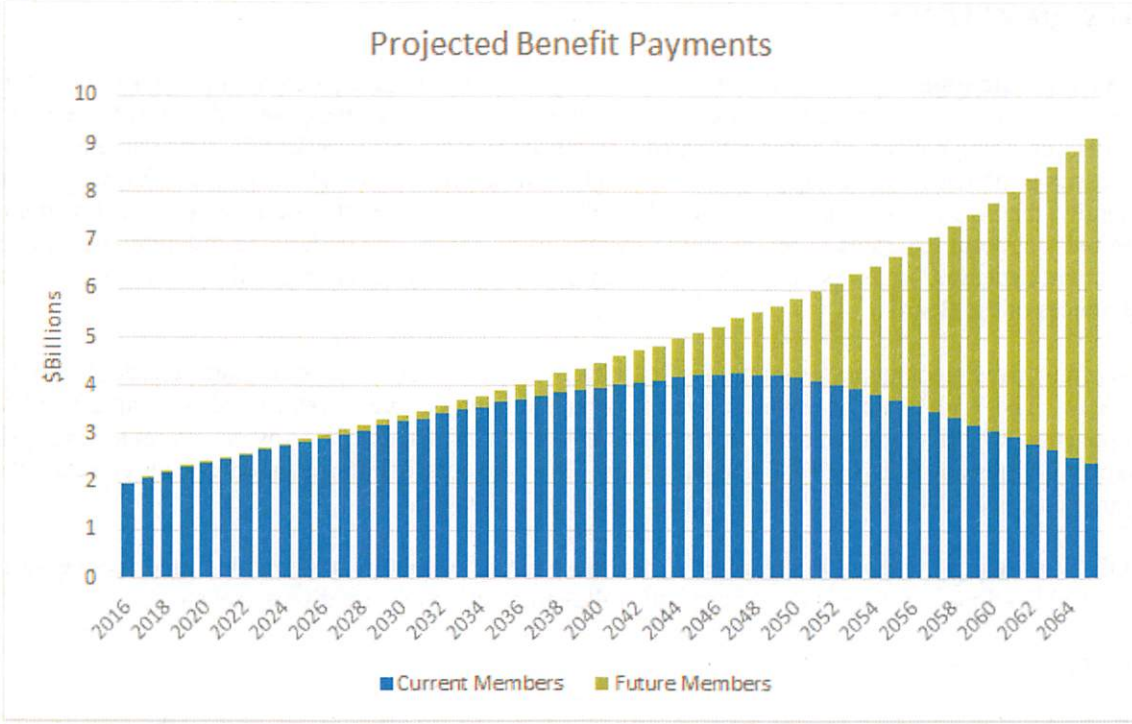
Use in the Valuation: The investment return assumption reflects anticipated returns on the current and future assets. It is one of the primary determinants in the calculation of the expected cost of the System's benefits, providing a discount of the estimated future benefit payments to reflect the time value of money. This assumption has a direct impact on the calculation of liabilities, normal costs, and contribution rates. Generally, the investment return assumption should be set with consideration of the asset allocation policy, expected long term real rates of return on the specific asset classes, the underlying inflation rate, and any investment expenses, but is also impacted by the dynamics of the system along with the risk tolerance and preferences of the Board.

The current investment return assumption is 7.50% per year, net of all investment-related and administrative expenses. The 7.50% rate of return is referred to as the nominal rate of return and is composed of two components. The first component is price inflation (previously discussed). Any excess return over price inflation is referred to as the real rate of return. The real rate of return, based on the current set of assumptions, is 4.50% (7.50% nominal return less 3.00% inflation).

ASOP 27 provides guidance to actuaries on the selection of economic assumptions used for measuring pension obligations. Our findings and analysis, following that ASOP, are discussed below.

Long Term Perspective

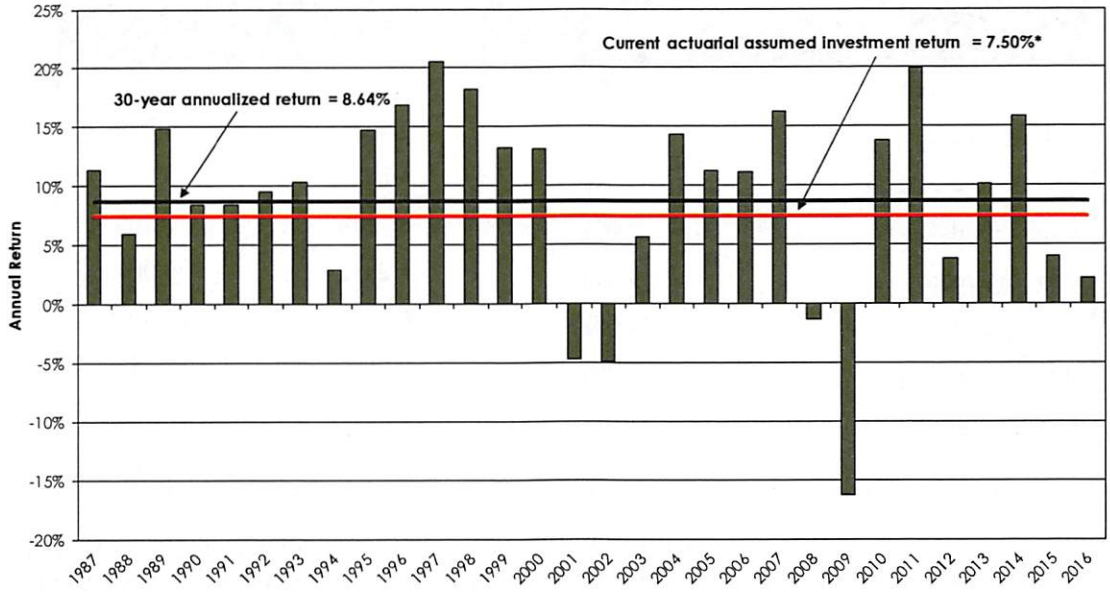
Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon so as to make prudent choices regarding how to invest the trust funds, i.e., asset allocation. For actuarial calculations, we typically consider very long periods of time as some current employees will still be receiving benefit payments more than 80 years from now. For example, a newly-hired teacher who is 25 years old may work for 35 years, to age 60, and live another 30 years, to age 90. The retirement system would receive contributions for the first 35 years and then pay out benefits for the next 30 years. During the entire 65-year period, the system is investing assets on behalf of the member. For such a typical career employee, more than one-half of the investment income earned on assets accumulated to pay benefits is received after the employee retires. In addition, in an open plan like IPERS, the stream of benefit payments is continually increasing as new hires replace current members who leave covered employment due to death, termination of employment, and retirement. This difference in time horizon is frequently a source of debate and confusion when setting economic assumptions. The following graph illustrates the long duration of expected benefit payments for current members on June 30, 2016, (blue bars) as well as the expected benefit payments for future hires (green bars) based on the valuation model.



IPERS Historical Perspective

One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the timeframe used, especially if the year-to-year results vary widely. In addition, asset allocation can also impact the returns so comparing results over long periods when different asset allocations were in place may not be meaningful.

The following graph shows the actual fiscal year (June 30) net returns for the IPERS portfolio for the last 30 years. Despite significant volatility in the results from year to year, the 30-year compound return has been 8.64% and the 20-year return has been nearly the assumed rate of 7.85%. Returns over shorter periods, such as 10 and 15 years, fall short of the current assumption.



*Actuarial interest rate assumption:
1953 - 1993: 6.50%
1994 - 1995: 6.75%
1996 - present: 7.50%

ANNUALIZED RETURNS through 6/30/16			
1-Year Return:	2.15%	15-Year Return:	6.62%
3-Year Return:	7.17%	20-Year Return:	7.85%
5-Year Return:	7.06%	25-Year Return:	8.43%
10-Year Return:	6.31%	30-Year Return:	8.64%

Forward Looking Analysis

We believe the most appropriate analysis to consider in setting the investment return assumption is to model the expected returns given the system's target asset allocation and forward-looking capital market assumptions. However, we are trained as actuaries and not as investment professionals. As such, we rely heavily on professional investment consultants, such as Wilshire, to provide investment expertise including capital market assumptions.

In performing our analysis, we use the building block approach so the real rate of return of the portfolio is modeled, based on the target asset allocation, and then the expected return is added to the price inflation assumption. Therefore, our analysis focuses on the real rate of return while the analysis of the investment consultants more typically focuses on the nominal return in their asset allocation consulting. IPERS' current target asset allocation, along with their investment consultant's (Wilshire Consulting) long-term capital market assumptions, are shown in the following table:

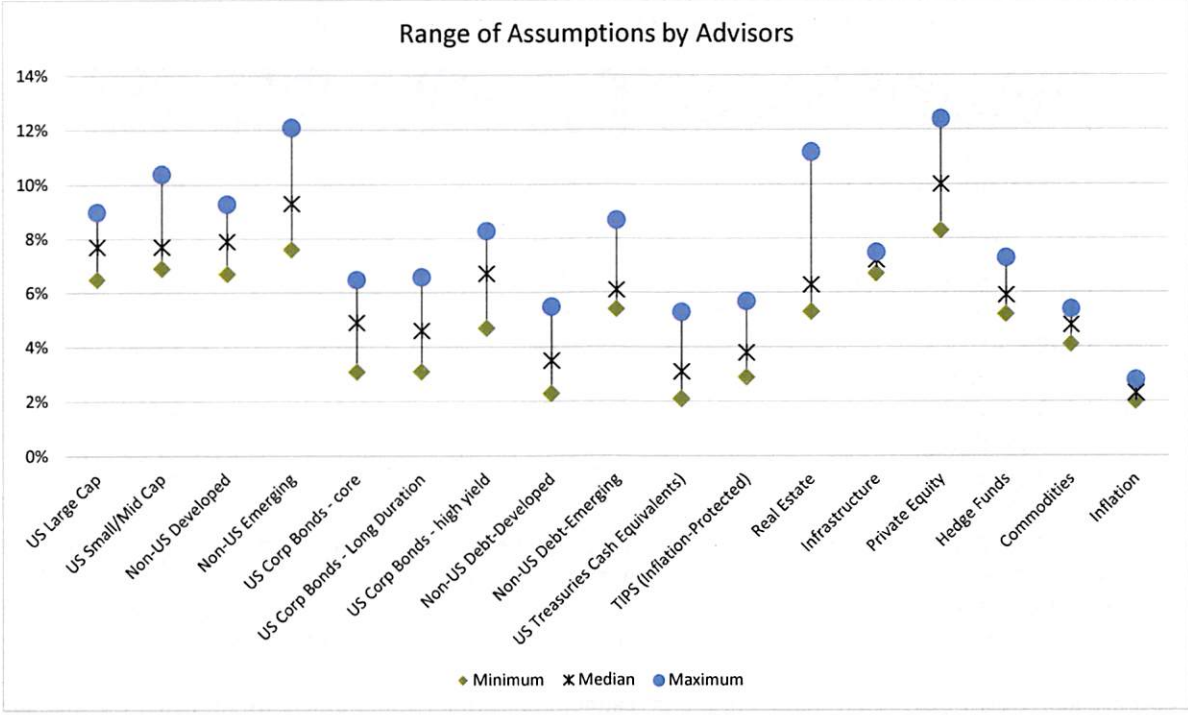
IPERS Target Asset Allocation and Wilshire's 30-Year Assumptions

Asset Class	Target Allocation	Real Rate of Return	Standard Deviation
Core Plus Fixed Income	27.0%	2.69%	5.00%
Public Credit	3.5%	4.85%	8.25%
Private Real Assets	7.5%	4.80%	10.80%
Public Real Assets	7.0%	3.78%	6.80%
Private Credit	3.0%	4.29%	6.00%
US Equity	24.0%	6.61%	17.00%
International Equity	16.0%	7.08%	18.75%
Private Equity	11.0%	11.36%	27.50%
Cash	1.0%	0.36%	1.25%

Based on their 2017 capital market assumptions, Wilshire's expected real compound expected return is 4.33% over the next 10 years. Combined with their short-term inflation assumption of 1.95%, the nominal return for the next 10 years is 6.28%. However, using Wilshire's 30-year assumptions, the expected real compound return is 5.09%. Combined with their inflation assumption of 2.33%, the nominal return over 30 years is 7.42%. These movements in expected return over time illustrate the variability of expected returns and the awareness that today's markets are expected to improve over time.

It should be noted that there is currently a fair amount of variation in expectations among investment professionals. Therefore, it can be beneficial to consider other advisors' expectations when setting the investment return assumption. Horizon Actuarial Services prepares an annual study in which they survey various investment advisors and provide ranges of results as well as averages. The 2016 Survey included a total of 35 investment advisors who provided their capital market assumptions of which 12 provided both short-term and long-term assumptions. It is worth noting that this Survey has historically been prepared for the multiemployer (Taft-Hartley) plan community and initially included assumptions only from investment advisors serving those plans. The Survey has expanded over the years and now includes assumptions from investment advisors outside of the Taft-Hartley community including consultants such as Aon Hewitt, New England Pension Consultants (NEPC), Callan Associates, Willis Towers Watson, JP Morgan, RVK, SEI, UBS, Summit Strategies, Blackrock and PCA who work with public plans.

The following graph shows the minimum, maximum and median return assumption for each asset class for the 12 firms providing long-term assumptions in the Horizon Survey.



It is important to reemphasize that the assumptions used by most investment consultants are usually intended to assist the Board with determining asset allocations, and thus may be more short-term in nature (10 years) and reflective of the current market conditions more than the investment return assumption developed by the actuary for funding the benefits and measuring liabilities. Although this has always been the case, the significant difference that currently exists in expected returns over the short term versus the long term causes more of a challenge in setting the investment return assumption.

Wilshire's 30-year assumptions produce an expected nominal return of 7.42% compared to their 10-year expected return of 6.28%. If only the real rate of return is considered, the difference is still significant: 5.09% over 30 years compared to 4.33% for the 10-year return. A similar outlook is evident for the 12 consultants included in the Horizon Survey who provided both short-term (10 years) and long-term (20 years) assumptions. The long-term assumptions from the Horizon Survey provide an additional perspective on the magnitude of the potential difference in expected return over a longer timeframe. The following table provides a sample of the differences in the 10-year and 20-year horizon assumptions for the 12 advisors who provided both short-term and long-term assumption sets in the Survey:

Average Expected Real Returns: Short-Term vs. Long-Term

Asset Class	10-Year Horizon	20-Year Horizon	Difference
US Equity – Large Cap	4.63%	5.58%	0.95%
US Equity – Small/Mid Cap	4.85%	5.92%	1.07%
Non-US Equity – Developed	5.11%	5.71%	0.60%
Non-US Equity - Emerging	6.40%	6.80%	0.40%
US Corporate Bonds – Core	1.19%	2.27%	1.08%
US Corporate Bonds – High Yield	3.96%	4.50%	0.54%
TIPS	0.90%	1.63%	0.73%
Real Estate	4.30%	4.44%	0.14%
Infrastructure	4.21%	4.81%	0.60%
Private Equity	7.23%	8.02%	0.79%
Inflation	2.22%	2.31%	0.09%

Over the longer term, the expected real return for the IPERS portfolio based on the input of the 12 investment consultants in the Horizon Survey who provided long-term assumptions was 5.21%, 0.92% higher than the expected real return using the short-term assumptions from the Horizon Survey. This is somewhat higher than the difference of 0.76% between Wilshire's short and long-term assumptions.

For a broader view of expected returns in the investment consultant community, we modeled the median capital market assumptions of the investment consultants included in the 2016 Horizon Actuarial Survey and compared the results to those of Wilshire. As actuaries, our focus is on the timeframe of the expected benefit payments in the valuation so a longer term view of 30 to 50 years is appropriate. Therefore, the capital market assumptions for the 12 investment consultants in the 2016 Horizon Survey who also provided 20-year assumptions provide some valuable insight as to the potential difference in perspective based on the timeframe. Using the median of the expected return and standard deviation for each asset class from the 2016 Horizon Survey and IPERS' target asset allocation, the expected real rate of return and distribution of returns were modeled. The published asset classes in the Horizon Survey did not perfectly match all of the asset categories in the IPERS portfolio, so Wilshire assisted Cavanaugh Macdonald in developing an appropriate blend of the available asset classes for modeling the expected return. In addition, it is important to note that the capital market assumptions used in modeling expected returns are generally based on indexed returns and do not reflect any additional returns that may be earned due to active asset managers outperforming the market ("alpha"), net of investment expenses.

The projection results produce an expected range of real rates of return over a 30 year time horizon as shown in the following table, along with a comparison to Wilshire's 30-year assumptions.

LONG-TERM CAPITAL MARKET ASSUMPTIONS

Percentile	Real Returns by Percentile	
	Wilshire	Horizon
95th	8.35%	8.53%
75th	6.41%	6.56%
50th	**5.09%**	**5.21%**
25th	3.78%	3.88%
5th	1.92%	1.99%

We find some value in considering the pooled result of many different investment firms, including many major investment consultants in the public plan arena. Consequently, we believe there is value in considering both Wilshire's and the Horizon capital market assumptions in our analysis although we recognize that survey information has its limitations and that Wilshire has more insight and specific knowledge about the IPERS' portfolio. Likewise, we believe there is also value in considering the return expectations using both the short-term and longer-term assumptions.

The following table summarizes the expected return using the short-term and long-term capital market assumptions of Wilshire and the Horizon Survey with the recommended inflation assumption of each.

	Wilshire's 10-Year	Wilshire's 30-Year	Horizon Survey 10-Year	Horizon Survey 20-Year
Real Return	4.33%*	5.09%*	4.29%	5.21%
Price Inflation	1.95%	2.33%	2.16%	2.31%
Total	6.28%	7.42%	6.45%	7.52%

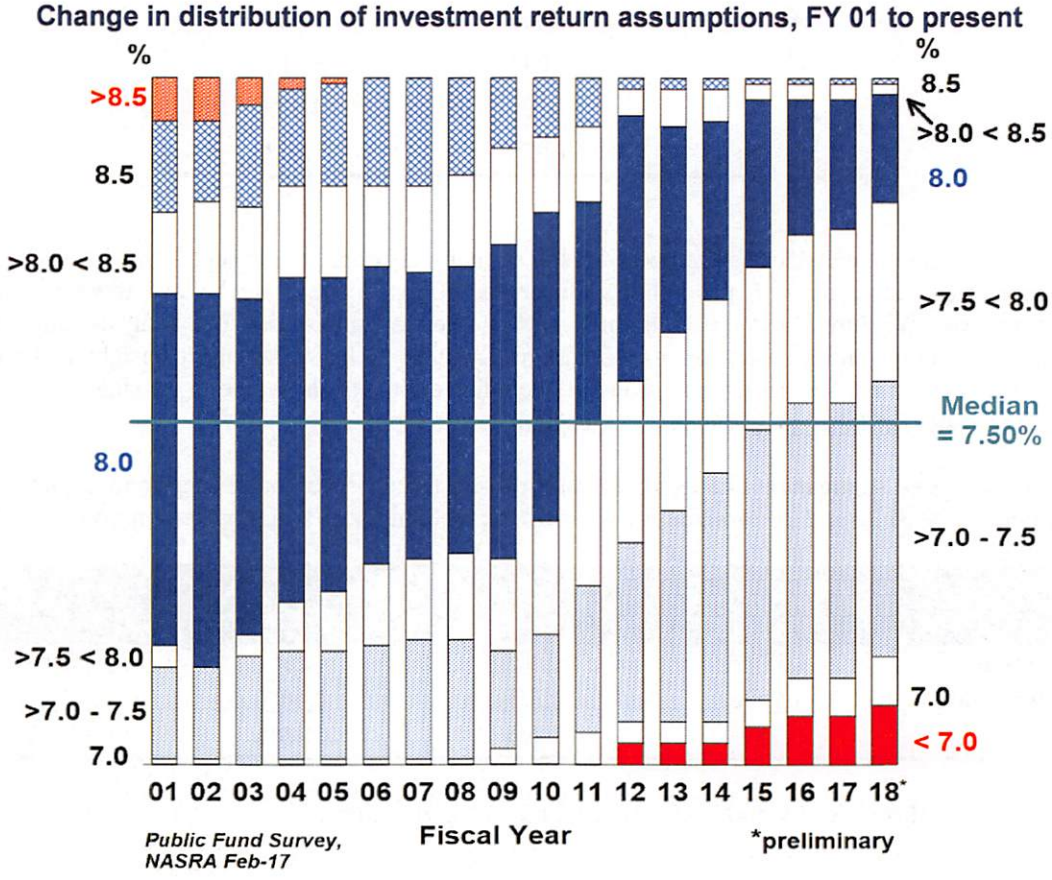
*Based on Wilshire's 2017 capital market assumptions.

Peer System Comparison

Public retirement systems have historically compared their investment performance to their peer group. While we believe there is some merit in assessing the movement in the assumed rate of return for other systems, this is not an appropriate basis for setting this assumption in our opinion. For example, different plans have different plan dynamics which will impact their choice of the assumed investment return. This peer group information merely provides another set of relevant data to consider as long as we recognize that asset allocation varies from system to system.

The graph below shows the change in the distribution of the investment return assumption from fiscal year 2001 through August, 2016 for the 120+ large public retirement systems included in the NASRA Public Fund Survey. As it indicates, the investment return assumptions used by public plans have decreased over

the last fifteen years, likely heavily impacted by a corresponding decrease in the underlying inflation assumption from 4.0% to 3.0% over the same period. It is worth noting that the median investment return assumption in fiscal year 2012 dropped from 8.00% to 7.75% and has declined further to 7.50% in 2016. We believe we will continue to see more of the systems who are using an 8.0% or higher assumption move to a lower assumption as future experience studies are completed in the next few years.



INVESTMENT-RELATED AND ADMINISTRATIVE EXPENSES

The analysis in the preceding section utilized Wilshire's capital market assumptions which were developed to be net of fees, but assumed passive investment in equities and bonds. IPERS pursues an active investment approach in some cases, but it is reasonable to assume that this strategy will produce sufficient additional returns to offset the expense of active management. Consequently, there is no need to adjust the results of the prior section for investment-related expenses.

IPERS does incur certain administrative expenses that are paid from the trust. The following table shows the ratio of administrative expenses to assets over the last nine fiscal years.

Fiscal Year	Administrative Expenses ($M)	Actuarial Value Assets ($M)	Expense Ratio
2016	$14.9	$27,915	0.05%
2015	12.6	26,460	0.05%
2014	14.9	24,711	0.06%
2013	12.1	23,530	0.05%
2012	13.0	22,575	0.06%
2011	9.7	21,537	0.05%
2010	9.0	21,124	0.04%
2009	10.9	21,857	0.05%
2008	9.9	20,760	0.05%

The administrative expenses in recent years have averaged around 0.05% so we believe that is a reasonable assumption for the reduction in expected return due to administrative expenses.

Possible Approaches

This is a particularly challenging period to evaluate and set the investment return assumption due to the disparity between expected returns over the short term (next 5 to 10 years) and the longer term (20 to 30 years). The consensus of the investment consulting community seems to be that short-term returns will be materially lower than both historic returns and projected returns over the longer term. There are different approaches to consider when setting the investment return assumption:

(1) Maintain a long-term investment return assumption that will be higher than the short-term expectations. If short-term expectations prove correct, these plans are likely to experience a steady increase in unfunded actuarial liabilities and costs in the next ten years.

(2) Lower the investment return assumption to reflect short-term expectations. These plans may experience an immediate increase in unfunded actuarial liabilities and costs. Part of this increase is a shifting to present funding periods an amount that will be funded by higher investment returns later, but are not anticipated by the calculations.

(3) Use a select and ultimate assumption to blend the expected returns over the short-term and long-term. This option has general appeal because it reflects both short-term and long-term expectations in the market, but it has some added complexities. This assumption would use the short-term assumption for the next 10 years (select) and then long-term assumption for all years thereafter (ultimate). Over time, as the system moves through the select period the effective investment return assumption gradually changes and eventually reaches the ultimate rate (at the end of the 10 year

period). There may also be other administrative complexities such as which actuarial assumptions should be used for optional forms of payment and service purchase calculations.

(4) Use a single return assumption that reflects both short-term and long-term return expectations, blended into a single investment return assumption. The rate would be higher than the short-term expected returns, but lower than the long-term expected return.

Recommendation:

Because investment earnings account for the majority of revenue for most public plans, the choice of an investment return assumption has a major impact on a system's financing and actuarial funded status. An investment return assumption that is too low will overstate liabilities and costs, causing current members/ taxpayers to be overcharged and future members/taxpayers to be undercharged. An investment return assumption that is too high will understate liabilities and undercharge current members/taxpayers at the expense of future members/taxpayers. An assumption that is significantly wrong in either direction will cause a misallocation of resources and unequitable distribution of costs among generations of members/taxpayers. Because of this, setting the investment return assumption requires a balancing act with an attempt to not be overly conservative nor aggressive.

By actuarial standards, we are required to maintain a long-term perspective in setting all assumptions, including the investment return assumption. Therefore, we believe we must be careful not to let recent experience or short-term expectations impact our judgment regarding an appropriate investment return assumption over the long term. However, given the material difference in expectations in the short and long term it is difficult to ignore the impact of the lower returns on the funding of the system.

Since experience studies are performed only every four years and investment consultants modify their capital market assumptions at least once a year, we do not believe basing the investment return assumption solely on the most recent estimate from one investment consultant or a survey of several investment consultants is reasonable. Such action could create significant and frequent fluctuations in the system's funded ratio and the corresponding actuarial contribution rate, creating unnecessary challenges in funding the system. Our goal is to choose an assumption that will be reasonable over the long-term with infrequent adjustments. We expect to change this only when there are compelling changes to investment policy, changes in the underlying inflation assumption, or evidence of a change in the long-term trends in the capital markets.

Wilshire's 2017 long-term capital market assumptions result in a real return of 5.09% and their short-term capital market assumptions produce a real return of 4.33%. IPERS' current real rate of return assumption is 4.50%, which is between short-term expectations and long-term expectations. The median investment return used by other large statewide systems is currently 7.50%. This is a good indicator of the real return expectations of the broad public plan community although it is important to recognize that asset allocation varies by system. IPERS tends to have an asset allocation somewhat more conservative than the average system in the Public Fund Survey. Therefore, a rate of return lower than the median seems a reasonable expectation. If the 4.50% real return is retained, the recommended investment return assumption would be 7.10% (4.50% real return plus 2.60% inflation). After a small reduction for administrative expenses, a nominal return of 7.00% seems reasonable.

There are clearly other investment return assumptions that would also be considered reasonable under actuarial standards of practice and we are willing to engage in a discussion with the Board about other assumptions, if desired. The Board's expectations for future returns, the relative weighting to assign to the results of different analyses, and the Board's risk perspective may also influence the Board's selection of the investment return assumption.

Investment Return	
Current Assumption	7.50%
Recommended Assumption	7.00%

GENERAL WAGE GROWTH

Background: General wage growth, thought of as the "across the board" rate of salary increases, is composed of the price inflation assumption and an assumption for the real rate of wage increases/real wage growth. The excess of wage growth over price inflation represents the increase in the standard of living, also called productivity growth.

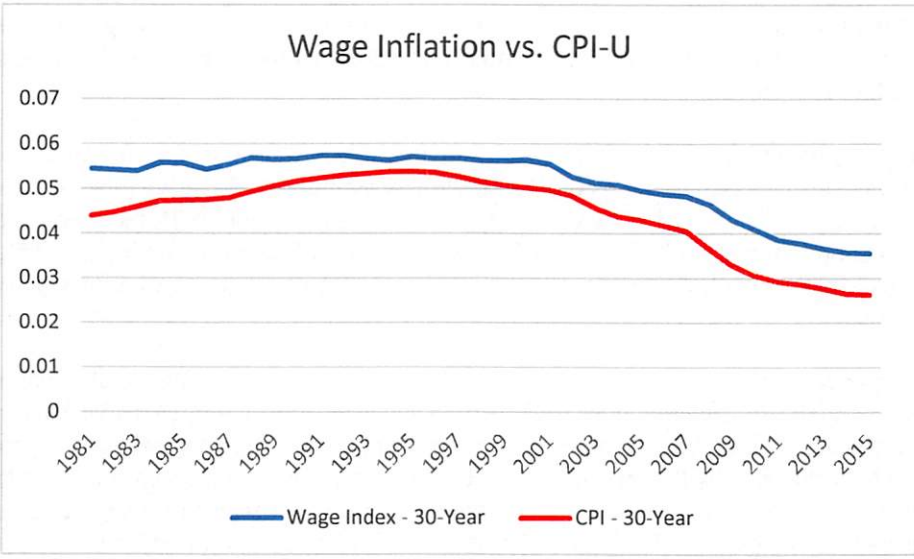
In constructing the salary increase assumption used to project future salary increases for individual members, the wage growth assumption is combined with an assumption for service-based salary increases (called a merit scale). The service-based salary increase assumption will be addressed when the demographic assumptions are studied. Given the current price inflation assumption of 3.0%, the current wage growth assumption of 4.0% implies an assumed real rate of wage increase or real wage growth assumption of 1.0%.

Historical Perspective: Wage statistics are found in the Social Security System database on the National Average Wage data. This information goes back to 1955 and is the most comprehensive database available. Because the National Average Wage is based on all wage earners in the country who are covered by Social Security, it can be influenced by the mix of jobs (full-time vs. part-time, manufacturing vs. service, etc.) as well as by changes in some segments of the workforce that are not seen in all segments (e.g. regional changes or growth in computer technology). Furthermore, if compensation is shifted between wages and benefits, the wage index would not accurately reflect increases in total compensation. IPERS membership is composed exclusively of governmental employees working in Iowa, whose wages and benefits are somewhat linked as a result of state and local tax revenues, funding allocations, and governing policies. Because the competition for workers can, in the long term, extend across industries and geography, the broad national earnings growth will have some impact on IPERS members. In the shorter term, however, the wage growth of IPERS and the nation may be less directly correlated.

The excess of wage growth over price inflation represents the real wage growth rate. The following table shows the compounded wage growth over various periods, along with the comparable price inflation rate for the same period. The differences represent the real wage growth rate. The data for each year is documented in Exhibit 3.

Years	Period	General Wage Inflation	CPI Increase	Real Wage Inflation
2006-2015	10	2.7%	1.8%	0.9%
1996-2015	20	3.4%	2.2%	1.2%
1986-2015	30	3.6%	2.7%	0.9%
1976-2015	40	4.4%	3.7%	0.7%
1966-2015	50	4.8%	4.1%	0.7%
1956-2015	60	4.6%	3.7%	0.9%

Similar information over rolling thirty year periods is shown in the following graph:



We would note that the Social Security Administration data and assumptions are based on increases in the average or mean wage. Over the past 25 years, mean real wage growth, as measured by the Administration, averages 0.77% per year. However, over the same time period the increase in the median real wage was only 0.42% per year, as much of the increase in wages occurred at the top end of the wage scale. Median real weekly non-farm wages has increased by only 0.21% from 1985 to 2015 and by 0.24% from 2005 to 2015, based on the Bureau of Labor Statistics (BLS) Current Population Survey.

Forecasts of Future Wages: The wage index used for the historical analysis is projected forward by the Office of the Chief Actuary of the Social Security Administration in their 75-year projections. In the June, 2016 Trustees Report, the annual increase in the National Average Wage Index under the intermediate cost

assumption (best estimate) was 3.8%, 1.2% higher than the Social Security Administration's intermediate inflation assumption of 2.6% per year. The range of the assumed real wage growth in the 2016 Trustees report was 0.5% to 1.8% per year.

Analysis and Conclusion: Over the last 30 years, the actual experience on a national basis has been close to the current assumption. However, this is based on SSA data which uses the average wages of all US workers. As mentioned earlier, the median real wage increase has been significantly lower. We believe that wages will continue to grow at a greater rate than prices over the long term, although not at the level projected by Social Security. We also expect wage growth for governmental employees to be lower than the national average, at least in the short term, due to budget challenges still being experienced by both state and local governmental employers.

Based on the available data and our professional judgment, **we recommend that the long-term assumed real wage growth be lowered from 1.00% to 0.65% per year. When coupled with the reduction in the price inflation assumption to 2.60%, the resulting general wage growth assumption decreases from 4.00% to 3.25%.**

GROWTH IN MEMBERSHIP

We propose continuing the assumption that no future growth in membership will occur. This assumption affects the amortization payment rate, which is the portion of the total contributions used to pay off the unfunded actuarial liability. With no assumed growth in membership, future salary growth due only to general wage increases is anticipated. If increases should occur not only because of wage increases, but also because of additional members, there will be a larger pool of salaries over which to spread the unfunded actuarial liability, which would result in lower UAL payments as a percent of payroll. The uncertainties in light of current conditions in public employment and the national economy argue against anticipating any increase in membership for funding purposes.

PAYROLL GROWTH ASSUMPTION

Amortization payments on the unfunded actuarial liability are currently determined as a level percent of payroll. Therefore, the valuation requires an assumption regarding future annual increases in covered payroll. The wage growth assumption is typically used for this purpose. The current payroll growth assumption for IPERS is 4.00%, the same as the current wage growth assumption.

Based on the recommended wage growth assumption of 3.25%, we recommend the payroll growth assumption also be set at 3.25%.

Consideration could be given to the use of a lower payroll growth assumption, like 3.00%. This change would provide some conservatism in the funding of the UAL by effectively increasing the dollar amounts of contributions in the earlier years of the amortization period. We reviewed IPERS' actual payroll growth over the last 15 years which was about 3.5% per year. After adjusting for membership growth, the actual payroll growth was about equal to the general wage growth in the economy for that period. Therefore, we do not believe a lower payroll growth assumption is necessary unless the Board wishes to amortize the UAL more rapidly. We would be happy to discuss this alternative payroll growth assumption, should the Board be interested.

SUMMARY

The following table summarizes the current set of economic assumptions along with the recommended set of economic assumptions:

	Current Assumptions	Recommended Assumptions
Price Inflation	3.00%	2.60%
Investment Return	7.50%	7.00%
Interest on Member Accounts	3.75%	3.50%
General Wage Growth	4.00%	3.25%
Payroll Growth	4.00%	3.25%

Exhibit 1

U.S. Consumer Price Index

December of:	Index	Increase	December of:	Index	Increase
1928	17.1				
1929	17.2	0.6 %	1973	46.2	8.7%
1930	16.1	-6.4	1974	51.9	12.3
1931	14.6	-9.3	1975	55.5	6.9
1932	13.1	-10.3	1976	58.2	4.9
1933	13.2	0.8	1977	62.1	6.7
1934	13.4	1.5	1978	67.7	9.0
1935	13.8	3.0	1979	76.7	13.3
1936	14.0	1.4	1980	86.3	12.5
1937	14.4	2.9	1981	94.0	8.9
1938	14.0	-2.8	1982	97.6	3.8
1939	14.0	0.0	1983	101.3	3.8
1940	14.1	0.7	1984	105.3	3.9
1941	15.5	9.9	1985	109.3	3.8
1942	16.9	9.0	1986	110.5	1.1
1943	17.4	3.0	1987	115.4	4.4
1944	17.8	2.3	1988	120.5	4.4
1945	18.2	2.2	1989	126.1	4.6
1946	21.5	18.1	1990	133.8	6.1
1947	23.4	8.8	1991	137.9	3.1
1948	24.1	3.0	1992	141.9	2.9
1949	23.6	-2.1	1993	145.8	2.7
1950	25.0	5.9	1994	149.7	2.7
1951	26.5	6.0	1995	153.5	2.5
1952	26.7	0.8	1996	158.6	3.3
1953	26.9	0.7	1997	161.3	1.7
1954	26.7	-0.7	1998	163.9	1.6
1955	26.8	0.4	1999	168.3	2.7
1956	27.6	3.0	2000	174.0	3.4
1957	28.4	2.9	2001	176.7	1.6
1958	28.9	1.8	2002	180.9	2.4
1959	29.4	1.7	2003	184.3	1.9
1960	29.8	1.4	2004	190.3	3.3
1961	30.0	0.7	2005	196.8	3.4
1962	30.4	1.3	2006	201.8	2.5
1963	30.9	1.6	2007	210.0	4.1
1964	31.2	1.0	2008	210.2	0.1
1965	31.8	1.9	2009	215.9	2.7
1966	32.9	3.5	2010	219.2	1.5
1967	33.9	3.0	2011	225.7	3.0
1968	35.5	4.7	2012	229.6	1.7
1969	37.7	6.2	2013	233.0	1.5
1970	39.8	5.6	2014	234.8	0.8
1971	41.1	3.3	2015	236.5	0.8
1972	42.5	3.4	2016	241.4	2.1

Exhibit 2

National Average Wage Index

	Index	Increase		Index	Increase
1927	$1,159.14				
1928	1,162.53	0.3%	**1972**	$ 7,133.80	9.8%
1929	1,196.88	3.0	**1973**	7,580.16	6.3
1930	1,164.95	(2.7)	**1974**	8,030.76	5.9
1931	1,086.09	(6.8)	**1975**	8,630.92	7.5
1932	954.02	(12.2)	**1976**	9,226.48	6.9
1933	892.58	(6.4)	**1977**	9,779.44	6.0
1934	929.34	4.1	**1978**	10,556.03	7.9
1935	968.53	4.2	**1979**	11,479.46	8.7
1936	1,008.20	4.1	**1980**	12,513.46	9.0
1937	1,071.58	6.3	**1981**	13,773.10	10.1
1938	1,047.39	(2.3)	**1982**	14,531.34	5.5
1939	1,076.41	2.8	**1983**	15,239.24	4.9
1940	1,106.41	2.8	**1984**	16,135.07	5.9
1941	1,228.81	11.1	**1985**	16,822.51	4.3
1942	1,455.70	18.5	**1986**	17,321.82	3.0
1943	1,661.79	14.2	**1987**	18,426.51	6.4
1944	1,796.28	8.1	**1988**	19,334.04	4.9
1945	1,865.46	3.9	**1989**	20,099.55	4.0
1946	2,009.14	7.7	**1990**	21,027.98	4.6
1947	2,205.08	9.8	**1991**	21,811.60	3.7
1948	2,370.53	7.5	**1992**	22,935.42	5.2
1949	2,430.52	2.5	**1993**	23,132.67	0.9
1950	2,570.33	5.8	**1994**	23,753.53	2.7
1951	2,799.16	8.9	**1995**	24,705.66	4.0
1952	2,973.32	6.2	**1996**	25,913.90	4.9
1953	3,139.44	5.6	**1997**	27,426.00	5.8
1954	3,155.64	0.5	**1998**	28,861.44	5.2
1955	3,301.44	4.6	**1999**	30,469.84	5.6
1956	3,532.36	7.0	**2000**	32,154.82	5.5
1957	3,641.72	3.1	**2001**	32,921.92	2.4
1958	3,673.80	0.9	**2002**	33,252.09	1.0
1959	3,855.80	5.0	**2003**	34,064.95	2.4
1960	4,007.12	3.9	**2004**	35,648.55	4.6
1961	4,086.76	2.0	**2005**	36,952.94	3.7
1962	4,291.40	5.0	**2006**	38,651.41	4.6
1963	4,396.64	2.5	**2007**	40,405.48	4.5
1964	4,576.32	4.1	**2008**	41,334.97	2.3
1965	4,658.72	1.8	**2009**	40,711.61	-1.5
1966	4,938.36	6.0	**2010**	41,673.83	2.4
1967	5,213.44	5.6	**2011**	42,979.61	3.1
1968	5,571.76	6.9	**2012**	44,321.67	3.1
1969	5,893.76	5.8	**2013**	44,888.16	1.3
1970	6,186.24	5.0	**2014**	46,481.52	3.5
1971	6,497.08	5.0	**2015**	48,098.63	3.5

Exhibit 3

Annual Rates of Price and Wage growth

Calendar Year Ends	National Wage Index	National Price CPI Index	National Implied Productivity Increase
1985	4.3%	3.8%	0.5%
1986	3.0%	1.1%	1.8%
1987	6.4%	4.4%	2.0%
1988	4.9%	4.4%	0.5%
1989	4.0%	4.6%	-0.7%
1990	4.6%	6.1%	-1.5%
1991	3.7%	3.1%	0.7%
1992	5.2%	2.9%	2.3%
1993	0.9%	2.7%	-1.9%
1994	2.7%	2.7%	0.0%
1995	4.0%	2.5%	1.5%
1996	4.0%	3.3%	1.6%
1997	5.8%	1.7%	4.1%
1998	5.2%	1.6%	3.6%
1999	5.6%	2.7%	2.9%
2000	5.5%	3.4%	2.1%
2001	2.4%	1.5%	0.8%
2002	1.0%	2.4%	-1.4%
2003	2.4%	1.9%	0.6%
2004	4.6%	3.3%	1.4%
2005	3.7%	3.4%	0.3%
2006	4.6%	2.5%	2.1%
2007	4.5%	4.1%	0.4%
2008	2.3%	0.1%	2.2%
2009	-1.5%	2.7%	-4.2%
2010	2.4%	1.5%	0.9%
2011	3.1%	3.0%	0.1%
2012	3.1%	1.7%	1.4%
2013	1.3%	1.5%	-0.2%
2014	3.5%	0.8%	2.7%
2015	3.5%	0.7%	2.8%