The Ryan ALM Pension Letter™
December 31, 2017
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Ronald Ryan, CEO, CFA

William F. Sharpe
Lifetime Achievement Award

Money Management Letter
Lifetime Achievement Award

Capital Link
Most Innovative ETF Award

IMN
ETF of the Year Award

Bernstein Fabozzi/Jacobs Levy
Research Paper of the Year Award

Index	Returns YTD 2017	Weights
Pension Liabilities:		
Market (Tsy STRIPS)	7.94%	100 %
ASC 715 (FAS 158)	21.30	
PPA (MAP 21 = 3 Segments)	15.41	
PPA (Spot Rates)	10.01	
GASB /ASOP (7.50% ROA)	7.50	
Pension Assets:		
Ryan Cash	0.78 %	5 %
Bloomberg Barclay Aggregate	3.54	30
S&P 500	21.80	60
MSCI EAFE Int'l	25.63	5
Asset Allocation Model	15.15 %	100 %
Pension Assets – Liabilities:		
Market	7.21	
ASC 715 (FAS 158)	-6.15	
PPA (MAP 21 = 3 Segments)	-0.26	
PPA (Spot Rates)	5.14	
GASB/ASOP (7.50% ROA)	7.65	

Using the Asset Allocation return above, the difference in pension asset growth vs. liabilities in 2017 was: **7.21%** (market valuation STRIPS), **-6.15%** (ASC 715), **-0.26%** (PPA 3 segment rates), **5.14%** (PPA-Spot Rates) and **7.65%** (GASB/ ASOP). Such valuations show the significant difference in not using *market* valuations. Most pension funds enjoyed a funded ratio surplus in 1999 but **pension asset growth has *underperformed* liability growth since by an estimated -160.34%** on a compounded index basis starting at 100 on 12/31/99!

		Total Returns	(Market Values)							
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Assets		-2.50	-5.40	-11.41	20.04	8.92	4.43	12.25	6.82	-24.47	19.43
Liabilities		25.96	3.08	19.47	1.96	9.35	8.87	0.81	11.76	33.93	-19.52
Difference:											
Annual		-28.46	-8.48	-30.89	18.08	-0.43	-4.44	11.44	-4.94	-58.40	38.95
Cumulative			-37.60	-73.40	-60.08	-66.13	-76.75	-64.60	-77.50	-181.53	-106.9
		2010	2011	2012	2013	2014	2015	2016	2017		
Assets		11.89	3.27	11.79	19.04	9.74	1.22	8.12	15.15		
Liabilities		10.13	33.77	4.46	-12.59	24.35	-0.49	1.92	7.94		
Difference:											
Annual		1.76	-30.50	7.33	31.63	- 14.61	1.71	6.20	7.21		
Cumulative	-115.67	-195.73	-194.30	-120.74	-177.14	-172.78	-163.36	-160.34			

IRS Announces 2018 Contribution / Benefits Limits

The IRS issued Notice 2017-64 which announced cost of living adjustments (COLA) that affect the dollar limitations on pension plans and related items for tax year 2018. The contribution limit for employees who participate in 401(k), 403(b) and most 457 plans is increased from $18,000 to $18,500. The limitation on the annual benefit under a defined benefit plan under Section 415(b)(1)(A) is increased from $215,000 to $220,000.

2017 Witnessed Flatening of U.S. Treasury Yield Curve

U.S. Treasury yield curve flattened considerably during the calendar year 2017 as follows:

	12/31/16	**12/31/17**	**Change**
1-year	0.81%	1.73%	92 bps
2-year	1.20%	1.89%	69
3-year	1.45%	1.97%	52
5-year	1.93%	2.21%	28
7-year	2.24%	2.33%	9
10-year	2.45%	2.41%	- 4
30-year	3.06%	2.74%	- 32
1 vs 30-year	225 bps	101 bps	-124
2 vs. 30-year	186 bps	85 bps	-101

Source: Ryan Indexes

Corporations Increased Pension Contributions to Avoid PBGC Premium Hike in 2018

NEPC's annual survey of corporate defined benefit plans concluded that funded ratios have improved partly due to increased plan contributions. NEPC's survey shows that only 2% of private plans are less than 70% funded while 19% are less than 70% funded. More than 22% are overfunded (up from 9% last year). The PBGC variable premiums for underfunded plans was an obvious reason for such contribution increase. For 2017, the PBGC charged a variable rate of $34 per $1,000 in unfunded benefits plus a participant fee of $69. In 2018, the variable rate rises to $38 (11.76% increase) and the flat fee to $74 (7.2% increase).

ALEC Report Calculates Public Pension Deficit at Over $6 Trillion

The American League Exchange Council (ALEC) released a report in early December where they calculate the unfunded pension of 280 state-administered pension plans at **$6.02 trillion.** This is based on using a risk-free U.S. Treasury discount rate of 2.142% vs. the average GASB discount rate of 7.37% used by these 280 plans. The statistics shown are:

> **Accrued Liabilities = $8.09 trillion**
> **Total Assets = $3.06 trillion**
> **Unfunded Liabilities = $6,02 trillion**
> **Average Funded Ratio = 33.7%**

Why Haven't Public Plans Funded Ratios Recovered?

The stock market has grown very well in recent years (S&P 500 = 8.48% annual returns last 10 years). So why haven't public pension funded ratios recovered? Pension math is certainly one answer. If you have a deep deficit, as most public pensions do, then assets have to work harder just to keep pace at the same funded ratio. At a 8% discount rate (ROA) a 70% funded ratio needs a 11.4% ROA to maintain a 70% funded status… 60% funded ratio needs a 13.3% ROA. Also since public pensions do not use market rates to discount their liabilities then you have

accounting and actuarial valuations which create a constant positive growth on liabilities. Since the ROA discount rate has trended down over the last five years, this increases liability growth even more. Lowering the discount rate from 8.0% to 7.0% increases liability growth by 20% (income = 8% + price return = 12% assuming a 12-year duration).

ROA and Contributions Calculation Confusion

Actuarial practices (ASOP 27) use the ROA to calculate projected contributions. In essence, the projected contributions + the growth of current assets at the ROA should fully fund the pension plan over an amortization period (30-years). The problem becomes when there is a significant funded status deficit as most plans have. If you grow the current assets market value by the annual ROA and then grow the actuarial valuation of liabilities (based on the ROA as the discount rate) by the same ROA growth rate… the funded status deficit grows by 8%. The difference in the dollar growth of assets vs. liabilities results in a higher contribution to fund this new deficit. The example below shows $60 of assets and $100 of liabilities both growing at the ROA of 8%. This creates a funded ratio of 60% and a funded status of ($40). In just five years, the dollar deficit grows 46.9%... and so does projected contributions? This **ASOP contribution procedure has no input for assets to ever outgrow liabilities**! Therein lies the problem.

> **Assets = $60**
> **Liabilities = $100**
> **Funded Ratio = 60%**
> **Funded Status = ($40)**
> **ROA = 8% Growth rate for Assets + Liabilities**
> **Deficit = Can *only* be reduced thru Contributions**

	Assets	$ Growth	Liabilities	$ Growth	Funded Ratio	Status
			Growth Rate = 8% ROA		Funded	
Start	$60.00	$ 4.80	$100.00	$ 8.00	60%	$ 40.00
Year 1	64.80	5.18	108.00	8.64	60	43.20
Year 2	69.98	5.60	116.64	9.33	60	46.66
Year 3	75.58	6.05	125.97	10.07	60	50.39
Year 4	81.63	6.53	136.05	10.88	60	54.42
Year 5	88.16	7.05	146.93	11.72	60	58.77

At same growth rate (ROA) Funded Ratio stable… but deficit increases 46.9% !

Solution: Assets Outgrow Liabilities

If assets and liabilities were marked to market (economic books), each pension plan would understand the true economics of their plan. GASB accounting rules distort economic reality by allowing a discount rate based on the ROA. Pension liabilities are a term structure of benefit payments. No single discount rate could ever price liabilities accurately. The Society of Actuaries (SOA) recommended that pensions create a set of *economic books* to help assets understand and manage to these liabilities. If interest rates stay the same or rise as a secular trend over the next five years, liability growth would be very low to even negative growth.

Solution: If the market value of assets would outgrow the market value of liabilities… the funded status improves. If interest rates trend upward (+60 bps per year), liability growth on a

market value basis would be around **-2.56%** per year (based on a 12-year duration for liabilities). Note: the market value of liabilities is priced at the risk-free Treasury discount rate (3% in example below). If assets could grow at just 5% per year on average, assets would outgrow liability growth (liability Alpha) by about 7.50% per year. In just five years, a 60% funded status grows to 88% with just a 5% asset growth rate… well below the ROA of 8.0%. A 70% funded ratio would grow to 108%... without help from contributions. The ROA, an absolute return target, is not the proper pension focus. Relative returns… asset growth vs. liability growth is the true pension growth target. This requires a Custom Liability Index (CLI) to calculate liability growth on a frequent and accurate market value basis.

Moral: you want assets to outgrow liabilities not the ROA!

Assumptions: Interest Rates go up 60 bp per year
30-year Treasury =   3.00% >> 6.00%
Growth Rate   =   (2.56%)   Annual
Liabilities duration = 12 years

	----- Annual Growth Rate -----			
Assets	**5.0%**	**6.0%**	**7.0%**	**8.0%**
Liabilities	**- 2.6%**	**-2.6%**	**- 2.6%**	**- 2.6%**
Alpha (Annual)	**7.6%**	**8.6%**	**9.6%**	**10.6%**
Funded Ratio 60%	**87.8%**	**92.1%**	**96.5%**	**101.1%**
	(without Contributions)			

IRS Gives Preview of 2019 Mortality Tables

Defined benefit plans are a victim or consequence of the new IRS mortality tables to be released for 2019. Updated mortality tables are used to calculate projected benefit payments which when discounted and compared to the present value of assets determine projected contributions and the PBGC premiums. The 2019 tables reflect a shorter life expectancy which should produce lower liabilities.

MSU Scholars Find $21 Trillion in Unauthorized Govt. Spending

Michigan state University economist, Mark Skidmore, and his team found $21 trillion in unauthorized spending in the departments of Defense and Housing and Urban Development for the years 1998-2015. The Department of Defense responded with the announcement that they will conduct the first independent financial audit in its history. Examples included the Army spending $6.5 trillion in unsupported adjustments in fiscal 2015.

Truth About Social Security

According to the Heritage Foundation… the Social Security (SS) trust fund is merely an accounting device filled with IOU's that taxpayers will repay. Soon, payroll taxes will be insufficient to pay all of the future SS promised benefits. Workers pay their SS payroll tax thru their employers. Each employer periodically sends a lump sum payment to the U.S. Treasury that includes all income taxes, SS taxes and Medicare payroll taxes paid by both employer and employee. The taxes received stay at the U.S. Treasury and do not go into the SS trust fund.

Instead two accounting entries are posted. The first estimates how much of the aggregate tax receipts are SS taxes and credits the SS trust fund with that amount. Then the Treasury subtracts the total amount paid in monthly SS benefits from the SS trust fund balance. No money actually changes hands. Any money remaining in the SS trust fund is converted into special issue Treasury bonds, which are really IOUs. The Treasury pays interest on the SS trust fund by crediting the trust fund with additional IOUs. Any excess SS trust funds after SS benefit payments are used by the federal government to fund any government expenses… it is not protected and separated as most trust funds are by their charter. Moreover, the SS trust fund are only invested in special issuance Treasury bonds not real assets of stocks, bonds, real estate, etc.. Latest data from the Treasury tell us that SS has asset reserves = $2.847 trillion. Starting in 2022, expenses will be greater than income. By 2034, asset reserves will be depleted but estimated interest income can fund 77% of projected expenses.

Social Security (SS) Beneficiaries Hit Record 61,859,250

According to the November release of data by the Social Security Administration, the number of SS beneficiaries hit a record of 61,859,250 which includes 10,426,607 disabled workers. According to the Bureau of Labor Statistics there are 126,827,000 full-time workers in America. That works out to only a 2.05 ratio… the lowest on record. Payroll taxes of 10.03% (Old Age and Survivors Insurance) + 2.37% (Disability Insurance) split equally between employer and employee fund the SS program. Starting in 2010, costs exceeded income for the first time. In 2016, costs exceeded income by $53 billion. For 2017, it is projected at $59 billion. The SS shortfall is estimated at $12.5 trillion over 75 years. The solution, as recommended by the SS Administration is to raise taxes or cut benefits or both. Currently, the federal debt stands at $20,492,874,492,282.58. This amounts to $133,142 of debt per each of the 153,918,000 people employed (full-time + part-time).

Duration Matching = Hedging Strategy… NOT De-Risking Strategy

Duration matching is designed to match the growth rate of liabilities. Since the duration of most liabilities are not provided by the actuary, most duration matching strategies use *generic* bond indexes as a proxy for liabilities. This is not an accurate or effective way to match liabilities. Liabilities are like snowflakes… you will never find two alike. Only through a Custom Liability Index (CLI) could you ever know the duration profile of liabilities which is quite interest rate sensitive. Since coupon bonds durations peak out at around 16 years, any liabilities longer than 16 years must be duration matched with high cost Treasury STRIPS. Moreover, buying a 5-year duration bond to match a 5-year duration liability, a 10-year duration bond to match a 10-year duration liability, etc., is not cost effective. Bond math is clear that the longer the maturity the lower the cost (purchase price) given the same yield. Moreover, the yield curve is usually positive sloping such that the longer bonds have higher yields which results in more cost savings. Please read my research paper *"How To De-Risk A Pension"* located in the research section of our web site www.RyanALM.com. **Futures, derivatives and interest rate swaps are certainly not de-risking strategies** since there are no funds to match and pay the liability benefit payment schedule. The objective of a pension should not be return oriented (i.e. the ROA). The 1990s should be a constant reminder of what happens when your focus is on a target return instead of the funded ratio and funded status. Had pension's *cash flow matched* liabilities in the 1990s when they had surpluses, there would be no pension crisis today!

Public Pension Watch List

Puerto Rico Finds $5 billion in Cash

Puerto Rico announced in mid-December that it has $5 billion more in cash than reported. It now reveals $6.9 billion in cash for the end of November, up from $1.73 billion reported on Dec. 1. This revelation came just days after a judge ordered the government to turn over more financial data to bondholders who have long complained of unreliable financial data. Such lack of credible data and transparency has been an obstacle in negotiations with creditors on a $74 billion government debt repayment bankruptcy trial. Judge Swain ruled in December that Puerto Rico must keep paying pension bondholders who are owed $13.9 million in interest each month. Lawyers for bondholders argue that the bondholders have a mandatory lien of 9.27% on any contributions made by government agencies to such pensions.

State of Connecticut has Most Underfunded Pension System in the Nation

According to ALEC, the state of Connecticut has more than $127.7 billion in unfunded pension liabilities. This leaves the state at just 19% funded. ALEC calculated this funded status based on a U.S. Treasury discount rate of 2.142%. This is in sharp contrast to the 47% funded ratio reported by the state using a 8.00% discount rate. Gov. Daniel Malloy and the State Retirement Commission have agreed to lower the discount rate to 6.99%. Initially, this should increase pension liabilities by about 12% and lower the funded ratio by about 6%. Annual contributions will grow from $1.5 billion per year to $2.2 billion by 2022. Pension, healthcare and debt service comprise over 50% of the state budget.

Kentucky Faces Budget Cuts of 17% to 25%

Speaking at a Paducah Chamber of Commerce luncheon, Rep. Steven Rudy suggested that budget cuts of 17% to 25% were needed for most state agencies to fund the budget and pensions. Rep. Gerald Watkins counted with… I don't see how we possibly going to be able to do that.

Ryan ALM Pension Scoreboard

The graphs below show asset vs. liability rolling 12 month and cumulative growth since 1999. Ryan ALM Benchmark Liability Index = **315.87%** growth while pension assets = **155.53%** growth for a difference of **–160.34% suggesting any pension Funded Ratio below 162.75% in 1999** has a deficit today on a *market weighted* basis.
    The Ryan ALM Pension Funded Ratio = 61.45% (starting at 100.00 on 12/31/99)

Ryan ALM, Inc.
Assets vs. Liabilities
(12 month rolling returns)

(12/31/1999 - 12/31/2017)

Ryan ALM, Inc.
Assets vs. Liabilities
Cumulative returns starting 12/31/1999

(12/31/1999 - 12/31/2017)

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The World of Ryan Indexes

Custom Liability Indexes … (Patent Pending)
The best way to price (discount rate) and understand the interest rate sensitivity of liabilities is the **Ryan Treasury STRIPS yield curve indexes** as a **LIABILITY INDEX BENCHMARK.** In March 1985, when STRIPS were born, the Ryan Financial Strategy Group (RFSG) created the **1st STRIPS Index.** Based upon these Ryan STRIPS indexes we created the **1st Liability Index** as the proper Liability Benchmark for liability driven objectives. The Ryan team has developed hundreds of Custom Liability Indexes (CLI). Similar to snowflakes, no two pension funds are alike with unique benefit payment schedules due to different labor forces, mortality and plan amendments. Until a CLI is installed as the benchmark, the asset side is in jeopardy of managing vs. the wrong objective (market indexes). **If you outperform generic market indexes, but lose to the CLI … the plan loses!**

Ryan Treasury Yield Curve Indexes (*Constant Maturity / Duration* series)
In March 1983, the Ryan Financial Strategy Group (RFSG) created the **1st Daily bond Indexes (the Ryan Index)** as a *Treasury Yield Curve constant maturity* index series for each **auction** maturity series (from Bills to Bonds). In March 1985, the day after Treasury STRIPS were born RFSG created the **1st Treasury STRIPS indexes** as a *Treasury Yield Curve constant duration* series of 1-30 year maturities (30 distinct constant duration indexes + composite**). The best way to measure interest rate risk is to use the Ryan Treasury Yield Curve Index series**.

RAFI Fundamental Weighted High Yield Index Series + RAFI Investment Grade Index Series
(PowerShares ETFs = PHB + PFIG)
In January 2010, Research Affiliates announced the creation of a series of bond indexes based on the RAFI fundamental weights. These include a short, intermediate long and composite Investment grade series and a short and intermediate High Yield series. Ryan ALM was honored and chosen as the index designer and calculation agent. In August 2010 the RAFI 1-10 year High Yield Index was launched as a **PowerShares ETF (PHB)**. There is also a Canadian hedged version **(PFH_CN)**. In September 2011 the RAFI 1-10 year Investment Grade index was launched as a PowerShares ETF **(PFIG)**. For more info on these ETFs and index, please go to:
www.Powershares.com   (click on fixed income portfolios)

Ryan/Nasdaq 1-30 year Treasury Maturity Ladder (PowerShares ETF = PLW)
On October 11, 2007 PowerShares launched a fixed income ETF **(PLW)** based upon the Ryan/Nasdaq 1-30 year Treasury Maturity Ladder index. This index is an equal-weighted diversified portfolio of 30 distinct maturities. For more info on this ETF and index, please go to:
www.Powershares.com   (click on fixed income portfolios)

Ryan ASC 715 (formerly FAS 158) Discount Rates
In 2006, Ryan ALM designed the FAS 158 yield curve index that prices any private pension liabilities in conformity to FAS 158 standards. We provide four distinct yield curves of AA corporate zero-coupon bonds in conformity to ASC 715.

Given the Wrong Index … you will get the Wrong Risk/Reward!

To view all Ryan Indexes data go to: www.RyanIndex.com

Ryan Index is a Registered Trademark of Ryan ALM, Inc.
In October 2005, Ron Ryan terminated his license agreement with Ryan Labs to distribute and calculate the Ryan Indexes and Ryan STRIPS Indexes. Ron Ryan and Ryan ALM have no affiliation with Ryan Labs. Any use of the formulas, methodologies and data of any of the Ryan Indexes without Ron Ryan's written permission is prohibited.

Pension Solutions:
Custom Liability Index and Liability Beta Portfolio™
_____*(Patent Pending)*_____

Ryan ALM offers a turnkey system of CLI + Liability Beta portfolio as a pension solution:

Custom Liability Index (Patent pending) - The first step in prudent pension management is to measure and monitor the liability objective frequently and accurately. Until liabilities are packaged as a **Custom Liability Index (CLI)** the asset side is in jeopardy of managing to the wrong objectives (i.e. market indexes). Only a CLI best represents the unique liability schedule of pensions. Just like snowflakes, no two pension liability schedules are alike due to different labor forces, salaries, mortality and plan amendments. How could a *generic market index* ever properly represent such a diverse array of pension liabilities? Once the CLI is installed the pension will now know the true **economic Funded Ratio** which should dictate the appropriate Asset Allocation, Asset Management and Performance Measurement. Ryan ALM is a leader in CLI as Ron Ryan was the inventor of the *first Liability Index* in 1991. In 2006, Ron won the *William F. Sharpe Index Lifetime Achievement Award*!

Liability Beta Portfolio (LBP) – The value added in bonds is small as every performance ranking study proves (1st quartile vs. median difference). **The best value in bonds is it's cash flow to match and fund liabilities** as Dedication, Immunization and Defeasance have proven for decades. Since liabilities are dynamic calculations they need a CLI to monitor their risk/reward behavior. The *core* or Beta portfolio for a pension should be in high quality bonds that match and fund liabilities. A Beta portfolio is defined as the portfolio that matches the objective. If the true objective is liability driven then, by definition, the proper beta portfolio for any liability objective must be … a **Liability Index Fund or Liability Beta Portfolio**. This requires a Custom Liability Index in order to be executed.

The Ryan ALM Liability Beta portfolio system will invest only in high quality securities that match the CLI. This provides our clients with the *lowest cost and lowest risk portfolio*. It is the lowest risk portfolio since it has:

> **No Interest Rate Risk   (matches CLI)**
> **No Liquidity Risk**
> **No Credit Risk**
> **No Event Risk**
> **No Prepay Risk**

The Ryan ALM Liability Beta portfolio is the lowest cost portfolio since we will always out yield liabilities by more than our very low fee thereby guarantying each client **No *Net* Fee**. Moreover, the Liability Beta portfolio is a cash flow matching liability portfolio that fully funds liabilities thereby reducing the cost and volatility of contributions.