RESOLUTION NO. 6314

Resolution Authorizing Pension Bonds and Related Matters

RECITALS

A. Portland Public Schools, Multnomah County, Oregon also known as Multnomah County School District 1J ("PPS" or the "District") is authorized by Oregon Revised Statutes ("ORS") 238.692 to 238.698 to issue revenue bonds pursuant to ORS Chapter 287A to finance its pension liability as defined in ORS 238.692(1); and

B. The District previously issued its Limited Tax Pension Bond, Series 2002, Limited Tax Pension Bond, Series 2003, and Limited Tax Pension Refunding Bond, Series 2012 (collectively, the "Prior Pension Bonds") to finance and refinance a portion of the District's share of the estimated unfunded pension liability at that time; and

C. In connection with the Prior Pension Bonds, the District entered into an intercept agreement (the "Intercept Agreement") with the State of Oregon Department of Education ("ODE") in which ODE agreed to divert State funding for the District that is legally available to pay debt service on such bonds (the "State Education Revenues") to a trustee for payment of the Prior Pension Bond debt service; and

D. School districts and education service districts have a pooled unfunded pension liability to the Oregon Public Employees Retirement System ("OPERS") and, based on the District's portion of the total school district and education service district payroll, the District's allocated portion of the unfunded pension liability (the "Pension Liability") is estimated to be $326,122,015 as of December 31, 2019; and

E. ORS 238.697 requires that the District (1) obtain a statistically based assessment from an independent economic or financial consulting firm regarding the likelihood that investment returns on bond proceeds will exceed the interest cost of the bonds under various market conditions and (2) make a report (the "Report") available to the general public that describes (a) the result of the assessment and (b) discloses whether the District has retained the services of an independent SEC-registered advisor; and

F. The Report is attached hereto as Exhibit A and the District has obtained an assessment (the "Assessment"), dated January 21, 2021 and further updated on April 15, 2021, from ECONorthwest, an independent economic consulting firm, which is attached to the Report; and

G. The District understands that the Assessment is based on facts and assumptions that are subject to change, including market projections that are anticipated to be updated by the Oregon Investment Council in June, 2021 and that in order to help evaluate the potential risk in the absence of updated market information, the Assessment was revised to include higher borrowing rate assumptions to approximate less-favorable future market conditions; and

H. Current interest rates in the bond market are below 4.50 percent, creating the opportunity for the District to finance all or a portion of its unfunded pension liability and potentially reduce its costs.

RESOLUTION

1. The Board of Directors (the "Board") of the District hereby authorizes the issuance of full faith and credit pension bonds ("Bonds") in accordance with this resolution and in an amount which does not exceed the amount necessary to produce net proceeds equal to the Pension Liability as reported by the OPERS's actuary as of the expected date of the lump sum payment, plus costs of issuing the Bonds.

2. Bond proceeds may be used to pay all or a portion of the Pension Liability and to pay costs of issuing the Bonds. The District may direct that a portion of the Bond proceeds be directly paid to OPERS after closing and a portion be retained by the District for payment to OPERS over time as determined by the District's Superintendent, Deputy Superintendent of Business & Operations, Chief Financial Officer, or the person designated by any of those individuals to act under this resolution (each a "District Official").

3. As of the date of this resolution, OPERS charges the District a rate of 7.20 percent per annum on its unfunded liability because that is the assumed rate of return that OPERS expects, over the long term, to earn on its investments. Issuing Bonds at a lower rate of interest and depositing proceeds at OPERS in a Side Account ("Side Account") may reduce costs for the District if the rate of return on the Bond proceeds deposited in the Side Account exceeds the borrowing costs. To maximize the potential for the rate of return on the OPERS fund to exceed the rate of interest on the Bond, the Bond shall not be sold at a true interest cost of more than 4.0% per annum.

4. The District Official shall compare the cash flows required to pay the Bonds to the payroll rate credit currently estimated from the Side Account and determine a Bond structure which the District Official estimates will be advantageous to the District.

5. The District Official is authorized to execute a letter to be sent to OPERS requesting the necessary payoff figures and to pay any fees required in connection therewith or, if such letter has been executed prior to the adoption of this resolution, the Board hereby ratifies such action.

6. In addition, the District Official may, on behalf of the District, and without further action by the Board:

    a. Sell or issue the Bonds in one or more series, which may be sold at different times.

    b. Participate in the preparation of, authorize the distribution of, and deem final any official statement or other disclosure documents relating to the Bonds.

    c. Enter into covenants for the benefit of owners of the Bonds that are intended to improve the terms under which the Bonds are issued.

    d. Apply for ratings on the Bonds and purchase municipal bond insurance or obtain other forms of credit enhancements for the Bonds, enter into agreements with the providers of credit enhancement, and execute and deliver related documents.

    e. Publish a notice of sale, receive bids and award the sale of each series of the Bonds to the bidder complying with the notice and offering the most favorable terms to the District, or select one or more underwriters or other lenders and negotiate the sale of any series with those underwriters or other lenders.

    f. Appoint a trustee, registrar, paying agent, municipal advisor, bond counsel, and/or any other professionals whose services are desirable for the Bonds and negotiate the terms of and execute any agreements with such professionals.

    g. Establish the final principal amount, payment schedule, interest rates (subject to the limit in Section 3 of this resolution), and other terms of the Bonds.

    h. Undertake to provide continuing disclosure for the Bonds in accordance with Rule 15c2-12 of the United States Securities and Exchange Commission and any other applicable requirements of the United States Securities and Exchange Commission and any other federal agencies.

i. Enter into one more trust agreements or similar documents, which describe the terms of the Bonds.

j. Execute and deliver a supplement to the Intercept Agreement and any related documents, in order to provide for diversion of State Education Revenues to a trustee to pay debt service on the Bonds, including a certificate demonstrating that State Education Revenues in each of the three most recently completed fiscal years is not less than two (2.0) times the average annual debt service on the Bonds and any other outstanding pension bonds issued under the Intercept Agreement, including the Prior Pension Bonds.

k. Issue any series of Bonds on a standalone basis, or as part of a pooled pension borrowing program that is expected to produce savings for the District, and enter into any agreements and execute any documents desirable to facilitate participation in that program.

l. Execute and deliver any agreements or other documents, and take any other action in connection with the Bonds that a District Official finds is desirable to issue the Bonds in accordance with this resolution.

7. The Bonds shall be payable from all lawfully available funds of the District and shall be secured by the District's full faith and credit and taxing power within the limitations of Article XI, Sections 11 and 11b of the Oregon Constitution as permitted by ORS 287A.315. The District may also pledge amounts under the Intercept Agreement, as it may be supplemented, to secure the Bonds.

8. This resolution shall take effect on the date of its adoption by the Board.

Exhibit A

Report on Pension Bonds

Prior to the issuance of full faith and credit pension bonds, Portland Public Schools, Multnomah County, Oregon also known as Multnomah County School District 1J (the "District") has obtained a statistically based assessment from ECONorthwest entitled "Issuance of Pension Obligation Bonds – A Risk/Reward Analysis" updated as of April 15, 2021 (the "Assessment") pursuant to ORS 238.697(1)(a). The Assessment was updated in order to include a fourth assumed pension bond true interest cost to help evaluate the potential risk associated with less-favorable future market conditions that may be projected in updated market information (anticipated to be available from the Oregon Investment Council in June, 2021).

The District has prepared this report pursuant to ORS 238.697(1)(b) (the "Report").

In connection with the issuance of pension obligation bonds, the District has retained the services of Piper Sandler & Co., an independent municipal advisor registered with the Securities and Exchange Commission.

The Assessment is attached to this Report as Exhibit 1.

A description of the results of the Assessment follows:

ECONorthwest
ECONOMICS · FINANCE · PLANNING

DATE: April 15, 2021
TO: Angie Peterman, Oregon Association of School Board Officials
FROM: ECONorthwest
SUBJECT: Pension Obligation Bond Analysis Executive Summary

Introduction

ECONorthwest recently conducted an analysis to evaluate the risks and rewards of issuance of Pension Obligation Bonds (POBs) by public employers that are part of the Oregon Public Employee Retirement System (OPERS).[1] For this analysis, we assumed that officials of governmental entities receiving our report are in a position to finance such bonds. Proceeds from the POBs would be added to, or used to create, side account balances to be managed in the same way as other PERS assets, by the Investment Division of the Oregon Treasury under the guidance of the Oregon Investment Council (OIC). This executive summary outlines the motivation for issuing POBs, our analytic methodology, and findings from our analysis. Additional details about the analysis are presented in our main report.

Background

Like many other states, Oregon's PERS has seen a growing gap between the cost of PERS benefits promised to participating public employees and the funding available for those benefits, resulting in an unfunded actuarial liability (UAL). Resolving the UAL will require increasing contributions from participating public employers over a long period of time. Pension obligation bonds, if issued in an economical manner and invested in a higher yielding portfolio, can potentially improve the ability of employers to pay their share of PERS obligations to the OPERS fund. Whether or not issuance of POBs makes sense in this setting will depend upon the likely evolution of side account returns relative to true interest cost (TIC) of the POBs.

Employers may benefit if the TIC of a bond issue is low relative to the potential return opportunities of a PERS side account over the same future period as the bond issues. However, this outcome is by no means assured. The true interest cost of carrying the POB debt would be known, but the employer also has to consider the risks associated

[1] The analysis provided in this document was developed by ECONorthwest for informational purposes only. All possible professional care was taken to prepare a realistic emulation of the likely POB side account behavior, and the OPERS procedures for accommodating POBs. State of the art modeling and statistical software was employed in this exercise. It should be recognized, however, that there are practical limits to the precision with which market and agency behavior can be modeled. The generic nature of the modeling performed may or may not be relevant to the circumstances of any one public employer. Additionally, nothing herein should be construed as offering investment advice or fairness opinions for the purpose of issuing securities. For this, interested parties should seek out professional counsel.

with committing future revenue paying to the POB debt. In addition, the future rate of returns to side account deposits are not known with certainty.

Portfolio allocation and other decisions made by the OIC influence the performance of the OPERS assets, as can the timing of the issuance of POBs. The primary determinants of the risk to POB issuers are (1) uncertainty in the performance of the asset classes that comprise the side account, (2) asset allocation choices made by the trustees of that account, and (3) the interactions of these factors with the POB strategy of the public employer(s).

To quantify these risks, our analysis models side account performance over time under various market conditions and bond issuance scenarios. The results quantify the potential risks and rewards of POBs under the assumed conditions.

Methodology

The model simulates side account performance using portfolio allocation targets obtained from OIC documents, and on forecasts of anticipated asset returns, based on reports from Oregon Treasury Investment Division staff, their consultants, and OPERS actuaries. We combine this information with assumptions about side account management. Specifically, we assume:

1. Side account balances are amortized at a constant share of payroll over the remaining life of the side account (assumed to expire on 12/31/2039, during fiscal year 2040).
2. Funds equal to the relevant percent of payroll are removed from the account as employer rate relief.
3. Earnings on side account deposits are credited annually.

To characterize the distribution of potential benefits to employers of POB issuance, we conduct 20,000 simulations of side account performance over the life of the account for each of four assumed POB TICs (2.5 percent, 3.5 percent, 4.5 percent, and 5.5 percent).[2] Each simulation represents a different, potential future path of account returns over time. For each simulation, we compare the benefits provided to employers in the form of rate relief to the cost of bond repayment. In doing so, we quantify two important measures of risk and reward:

[2] The fourth TIC of 5.5% was not modeled in our original report. In lieu of updated market projections (anticipated to be available from OIC in June, 2021), the additional scenario provides an alternative means to evaluate the potential risk of less-favorable future market conditions relative to those anticipated in our original report.

- **The present value (PV) of POB issuance.** This measure identifies the current value to employers of future benefits of POB issuance (the extent to which rate relief obtained exceeds bond repayments).

- **The probability that PV is greater than zero.** This measure of risk identifies the likelihood, given the assumptions in the model, that the current value of POB issuance would prove beneficial to the employer (if PV falls below zero, POB issuance is more costly to the employer than not issuing bonds).

Summary of findings

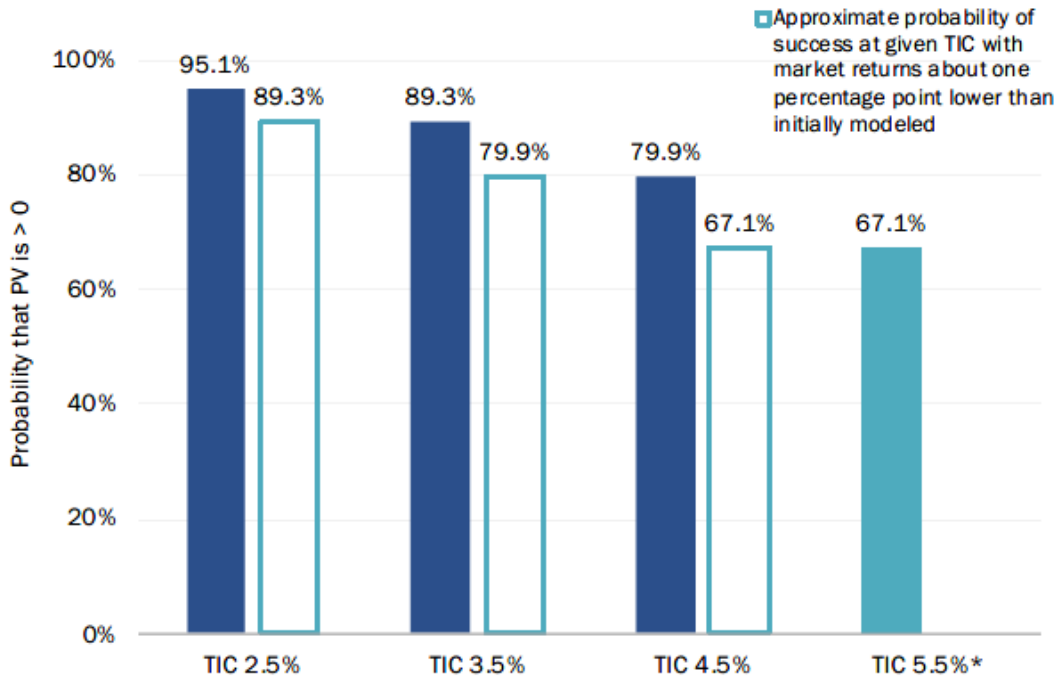
The findings presented below refer to an initial side account deposit of $1 million. The results can be scaled to approximate the potential risks and rewards of larger or smaller deposits. For example, a $2 million deposit would generate a benefit or loss of two times the dollar amounts shown in the charts and tables below. The probability that the PV is greater than zero depends on the TIC, not on the size of the initial deposit.

We added a fourth TIC of 5.5% to the analysis to help evaluate the potential risk associated with less-favorable future market conditions that may be projected in updated market information (anticipated to be available from OIC in June, 2021) relative to those anticipated in our original report. Output from the new scenario provides an approximate characterization of the potential risk inherent in less favorable market conditions than those modeled in the original report. For example, the 5.5% TIC scenario output is roughly analogous to a 4.5% TIC bond issue with market returns approximately one percentage point below those anticipated in our original analysis. The 4.5% TIC scenario can be similarly compared to the 3.5% TIC scenario output.

Our analysis assumes a maturity date for the bonds in fiscal year 2040. The projected annualized geometric mean return over the term of the bonds is 7.1, with a 5th percentile annualized return of 3.9 percent and a 95th percentile annualized return of 10.6 percent.

Figure 1 shows the probability that the present value of POB issuance is greater than zero. As the chart demonstrates, this probability declines as TIC increases. The solid bars show this probability for each TIC as initially modeled. The outlined bars show these probabilities based on our approximation of less favorable market conditions (e.g., at a TIC of 3.5%, the probability of a present value greater than zero is approximated by the modeled probability for a TIC of 4.5%).

Figure 1: Probability that the present value of POB issuance is greater than zero, various TICs



Source: ECONorthwest

*The fourth TIC of 5.5% was added to our analysis to help evaluate the potential risk associated with less-favorable future market conditions relative to those anticipated in our original report. For example, the 5.5% TIC scenario provides output that is roughly analogous to a 4.5% TIC bond issue with market returns approximately one percentage point below those anticipated in our original analysis. The 4.5% TIC scenario can be similarly compared to the 3.5% TIC scenario output, and so on.

Figure 2 illustrates the range (5th percentile, median, and 95th percentile) of present values obtained from the simulations for each TIC. This distribution shifts downward as TIC increases. At 2.5 percent TIC, the 5th percentile present value is close to zero. At 4.5 percent TIC the 5th percentile outcome is below zero and equal in magnitude to 16 percent of the initial deposit. For the additional 5.5 percent TIC scenario, at the 5th percentile the outcome is below zero and equal in magnitude to 22 percent of the initial deposit. These values, in combination with the probabilities described above, quantify some of the financial risks of POB issuance.

Figure 2: 5th percentile, mean, and 95th percentile present value, various TICs

Source: ECONorthwest

*The fourth TIC of 5.5% was added to our analysis to help evaluate the potential risk associated with less-favorable future market conditions relative to those anticipated in our original report. For example, the 5.5% TIC scenario provides output that is roughly analogous to a 4.5% TIC bond issue with market returns approximately one percentage point below those anticipated in our original analysis. The 4.5% TIC scenario can be similarly compared to the 3.5% TIC scenario output, and so on.

Figure 3 provides additional detail about the distribution of outcomes. As illustrated in earlier figures, outcomes at every point in the distribution are more positive at lower TICs. Present values are also somewhat more volatile at lower TICs, as evidenced by the higher standard deviations.

Figure 3: Distribution of present value and probability of a positive present value, various TICs

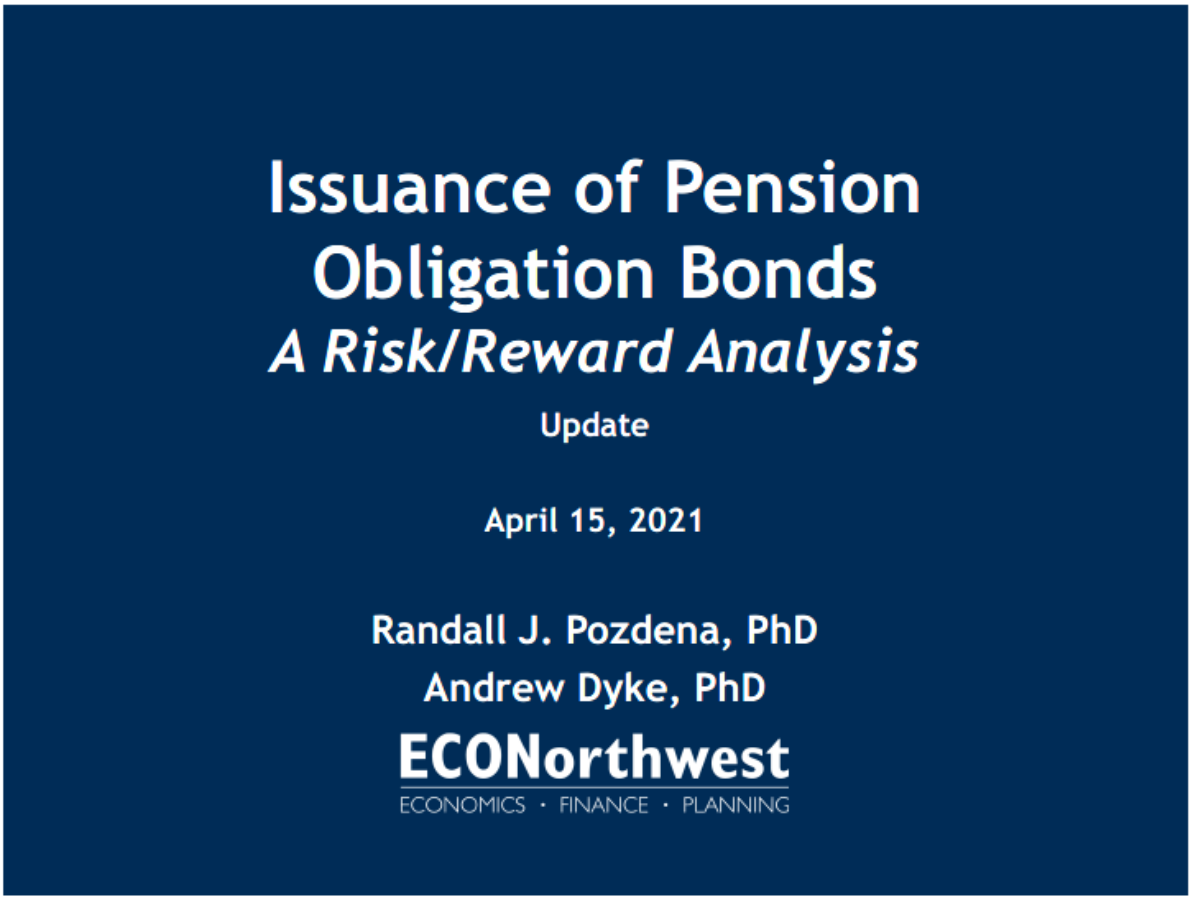
Rate (TIC)	2.5%	3.5%	4.5%	5.5%*
Mean	$548,932	$402,262	$274,215	$162,064
Std Deviation	$419,122	$370,750	$329,071	$293,051
Maximum	$3,393,617	$2,967,149	$2,592,638	$2,262,810
Minimum	$(336,091)	$(385,105)	$(428,435)	$(466,879)
95th Perc	$1,322,700	$1,088,074	$882,791	$703,077
90th Perc	$1,104,226	$893,399	$709,810	$548,797
75th Perc	$770,245	$599,774	$450,156	$320,087
50th Perc	$480,961	$342,299	$220,903	$114,852
25th Perc	$248,540	$136,280	$38,418	$(47,779)
10th Perc	$85,882	$(8,851)	$(91,354)	$(163,865)
5th Perc (VaR)	$2,913	$(82,433)	$(157,047)	$(222,771)
Zero Bound Perc	95.1%	89.3%	79.9%	67.1%

Source: ECONorthwest

*The fourth TIC of 5.5% was added to our analysis to help evaluate the potential risk associated with less-favorable future market conditions relative to those anticipated in our original report. For example, the 5.5% TIC scenario provides output that is roughly analogous to a 4.5% TIC bond issue with market returns approximately one percentage point below those anticipated in our original analysis. The 4.5% TIC scenario can be similarly compared to the 3.5% TIC scenario output, and so on.

Exhibit 1

Assessment



Introduction

ECONorthwest
ECONOMICS • FINANCE • PLANNING

Outline of Our Remarks

- Introduction
  - Basics of Pension Obligation Bonds (POBs)
  - Purpose of this Analysis
- Approach
  - Monte Carlo Methodology
  - Asset Return and Allocation Assumptions
  - Alternative Scenarios Modeled
- Model Findings
  - Side Account Performance and the Potential Benefits of POBs to Employers
- Implications
- Acknowledgements, Caveats and Disclaimers

This analysis was prepared to assist issuers of POBs in understanding the risks and returns of POBs under hypothetical conditions. Individuals should seek professional guidance concerning the relevance of this analysis to their circumstances.

3

Basics of POBs

- POBs are bonds issued by state or local governments to fund public employee pension obligations
  - First issued by City of Oakland in 1986 to arbitrage between tax-exempt borrowing rates and higher market investment yields of pension assets
- The Tax Reform Act of 1986 eliminated tax exemption for POBs
  - Higher yields of diversified portfolios relative to borrowing costs revived POB arbitrage opportunities in 1990s
- Still seen as a potential way to lower cost of pension funding
  - Use is heaviest by high-UAL plans (CA, IL, and OR)

This analysis was prepared to assist issuers of POBs in understanding the risks and returns of POBs under hypothetical conditions. Individuals should seek professional guidance concerning the relevance of this analysis to their circumstances.

4

Purpose of this Analysis

- Measure the potential risks and rewards of POBs
- The potential advantages of POBs to public employers depend upon the relative performance of the investment vehicle ("side account") and POB issuance costs
  - Issuance of POBs may reduce employer costs of pension funding
  - However, high side account yields are not achieved without risk
- Key measures of POB performance
  - The mean expected net present value (PV) of side account returns relative to POB total interest costs
  - The risk profile of the PV given uncertainty about side account returns
- This update includes a fourth TIC of 5.5% that was not modeled in the original report. In lieu of updated market projections (anticipated to be available from OIC in June, 2021), the additional scenario provides an alternative means to evaluate the potential risk of less-favorable future market conditions relative to those anticipated in our original report.

This analysis was prepared to assist issuers of POBs in understanding the risks and returns of POBs under hypothetical conditions. Individuals should seek professional guidance concerning the relevance of this analysis to their circumstances.

Approach

ECONorthwest
ECONOMICS • FINANCE • PLANNING

Approach: Monte Carlo Simulation

- Quantifying advantages to issuers is complex
  - The future path of asset yields is not known precisely
  - Side account management and actuarial treatment of POB contributions must be emulated
- ECONorthwest uses Monte Carlo techniques to simulate uncertainty in side account performance
  - Individual asset class returns are stochastic
  - Rebalancing behaviors are linked to asset returns paths
- ECONorthwest POB model also emulates POB and Plan features
  - Alternative Total Interest Cost (TIC) of the POB issue
  - Actuarial treatment of POB contributions

This analysis was prepared to assist issuers of POBs in understanding the risks and returns of POBs under hypothetical conditions. Individuals should seek professional guidance concerning the relevance of this analysis to their circumstances.

Model Assumptions

- Four issuance cost (TIC) assumptions: 2.5%, 3.5%, 4.5%, 5.5%*
- Our analysis uses the portfolio target and asset returns characteristics forecast for the OIC/OST in February 2020 by Callan, an investment consultant to OST.
- Current allocation based on OPERF valuation as of 10/31/2020.
- All analyses assume a $1 m. total POB contribution to facilitate scaling.
- Present value calculations include calculated earnings through December 2039 (assumed end of the side account) and bond costs through 2040.

*The fourth TIC of 5.5% was added to our analysis to help evaluate the potential risk associated with less-favorable future market conditions relative to those anticipated in our original report.

This analysis was prepared to assist issuers of POBs in understanding the risks and returns of POBs under hypothetical conditions. Individuals should seek professional guidance concerning the relevance of this analysis to their circumstances.

8

Asset Return and Allocation Assumptions

Asset Class	Future Returns and Volatility		Portfolio Allocation		
	Mean	St. Dev.	Range	Target	Current*
All Public Equity	--	--	27.5 - 37.5%	32.5%	29.3%
Broad U.S. Equity	7.2%	18.0%	--	16.3%	14.7%†
Global ex-U.S. Equity	7.3%	20.5%	--	16.3%	14.7%†
Illiquid alternatives	7.4%	12.5%	7.5 – 17.5%	15.0%	10.6%
Diversifying Strategies	6.0%	11.0%	0 – 5.0%	0.0%	2.1%
Fixed Income	2.8%	3.8%	15.0 – 25.0%	20.0%	20.2%
Private Equity	9.2%	26.3%	13.5 – 21.5%	17.5%	24.8%
Real Estate	7.0%	12.2%	9.5 – 15.5%	12.5%	11.0%
Risk Parity	6.3%	11.0%	0.0 – 2.5%	2.5%	2.0%

Source: ECONorthwest from Callan and OST data.

Notes:

* Current allocation is based on 10/31/2020 valuation.

† Values have been imputed using target allocations.

9

Asset Return and Allocation Assumptions

Asset Class Returns Correlation over Time

Asset Class	Broad US Equity	Global Ex-US Equity	Private Equity	Fixed Income	Real Estate	Illiquid Alternatives	Diversifying Strategies	Risk Parity
Broad US Equity	1.00	0.85	0.92	-0.11	0.69	0.43	0.23	0.55
Global Ex-US Equity	0.85	1.00	0.88	-0.14	0.66	0.40	0.20	0.55
Private Equity	0.92	0.88	1.00	-0.23	0.77	0.55	0.15	0.40
Fixed Income	-0.11	-0.14	-0.23	1.00	-0.06	0.02	0.15	0.45
Real Estate	0.69	0.66	0.77	-0.06	1.00	0.56	0.20	0.54
Illiquid Alternatives	0.43	0.40	0.55	0.02	0.56	1.00	0.17	0.29
Diversifying Strategies	0.23	0.20	0.15	0.15	0.20	0.17	1.00	0.33
Risk Parity	0.55	0.55	0.40	0.45	0.54	0.29	0.33	1.00

10

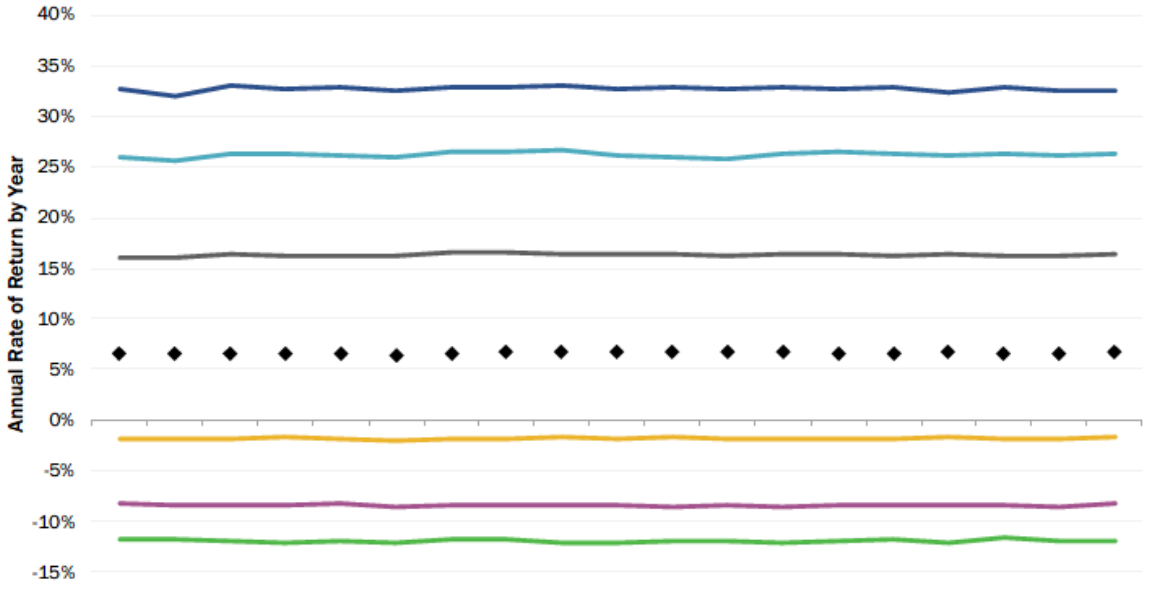
Amortization Assumptions

- Side account balances are influenced by amortization procedures
  - Balances amortized as a constant percent of payroll over remaining life of the side account (the account is assumed to end on 12/31/2039)
  - Each year, the percent of payroll that is determined by the amortization is taken out of the modeled side account balance for employer rate relief
  - Assumed earnings rate of 7.2% and 3.50% payroll growth rate are used in amortization
- Current plan procedures are incorporated:
  - Credited earnings and deducted transfers to the Employer Reserve for rate relief are accommodated
- Earnings are credited annually at the simulated portfolio rate of return
  - Applied to the beginning balance for the year minus one half of the amount taken out for rate relief

Model Results

ECONorthwest
ECONOMICS • FINANCE • PLANNING

Mean Annual Side Account Return and Range

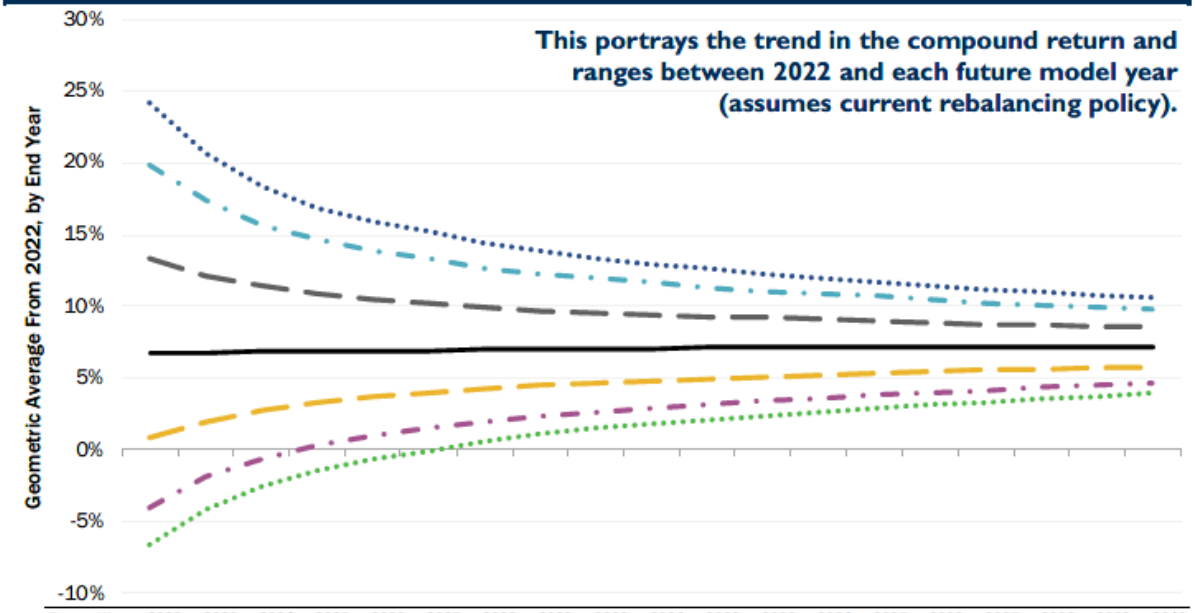


Percentile	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
95th	32.7%	32.0%	33.0%	32.8%	32.8%	32.5%	32.9%	32.9%	33.0%	32.7%	32.8%	32.7%	33.0%	32.7%	32.8%	32.4%	32.9%	32.5%	32.5%
90th	25.9%	25.6%	26.3%	26.2%	26.1%	25.9%	26.4%	26.5%	26.7%	26.1%	25.9%	25.8%	26.3%	26.4%	26.3%	26.1%	26.3%	26.2%	26.4%
75th	16.1%	16.0%	16.3%	16.3%	16.3%	16.2%	16.5%	16.5%	16.5%	16.4%	16.4%	16.3%	16.5%	16.3%	16.2%	16.4%	16.2%	16.2%	16.4%
50th	6.6%	6.5%	6.5%	6.6%	6.6%	6.3%	6.6%	6.7%	6.8%	6.7%	6.7%	6.7%	6.7%	6.6%	6.6%	6.7%	6.6%	6.6%	6.7%
25th	-1.8%	-1.8%	-1.9%	-1.7%	-1.8%	-2.0%	-1.8%	-1.8%	-1.7%	-1.8%	-1.7%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%	-1.7%
10th	-8.3%	-8.4%	-8.3%	-8.5%	-8.3%	-8.5%	-8.4%	-8.4%	-8.4%	-8.4%	-8.5%	-8.4%	-8.5%	-8.3%	-8.4%	-8.4%	-8.4%	-8.5%	-8.2%
5th	-11.7%	-11.8%	-12.0%	-12.1%	-12.0%	-12.1%	-11.8%	-11.8%	-12.1%	-12.2%	-12.0%	-12.0%	-12.1%	-11.9%	-11.8%	-12.0%	-11.6%	-11.9%	-11.9%

Mean Annual Side Account Returns (cont.)

- The forecast extends to fiscal year 2040, the last year the side account exists
  - Trend in mean annual return
    - Increase from 6.6% in 2022 to 6.7% as of the 2040 forecast horizon
  - Trend in 95th percentile return
    - Decreases from 32.7% in 2022 to 32.5% as of the 2040 forecast horizon
  - Trend in 5th percentile return
    - Decreases from -11.7% in 2022 to -11.9% as of the 2040 forecast horizon
- Trends are similar to recent forecasts by consultants to OIC/OST and OPERS

Geometric Mean Returns from 2022, by Year



Percentile	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
95th	24.2%	20.6%	18.4%	16.9%	15.9%	15.2%	14.4%	13.8%	13.4%	13.0%	12.6%	12.3%	12.0%	11.7%	11.4%	11.2%	11.0%	10.8%	10.6%
90th	19.8%	17.4%	15.7%	14.6%	13.9%	13.3%	12.7%	12.3%	11.9%	11.7%	11.3%	11.1%	10.9%	10.7%	10.5%	10.2%	10.1%	9.9%	9.8%
75th	13.3%	12.1%	11.4%	10.9%	10.5%	10.2%	10.0%	9.7%	9.6%	9.4%	9.3%	9.2%	9.1%	8.9%	8.9%	8.8%	8.7%	8.6%	8.5%
50th	6.7%	6.8%	6.8%	6.9%	6.9%	6.9%	7.0%	7.0%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%
25th	0.8%	2.0%	2.7%	3.3%	3.7%	4.0%	4.2%	4.5%	4.6%	4.8%	4.9%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%
10th	-4.0%	-1.9%	-0.6%	0.3%	1.0%	1.5%	1.9%	2.3%	2.6%	2.9%	3.2%	3.4%	3.6%	3.8%	4.0%	4.1%	4.3%	4.4%	4.6%
5th	-6.7%	-4.1%	-2.5%	-1.5%	-0.6%	0.0%	0.6%	1.1%	1.5%	1.8%	2.1%	2.4%	2.6%	2.9%	3.1%	3.3%	3.5%	3.7%	3.9%

Geometric Mean Returns (cont.)

- Fiscal year 2040 is the assumed final year of bonds
  - The projected annualized geometric mean return over the term of the bonds is 7.1%
  - The 95th percentile return is 10.6%
  - The 5th percentile return is 3.9%
- Again, the forecast returns are similar to those derived by other consultants to OIC and OPERS

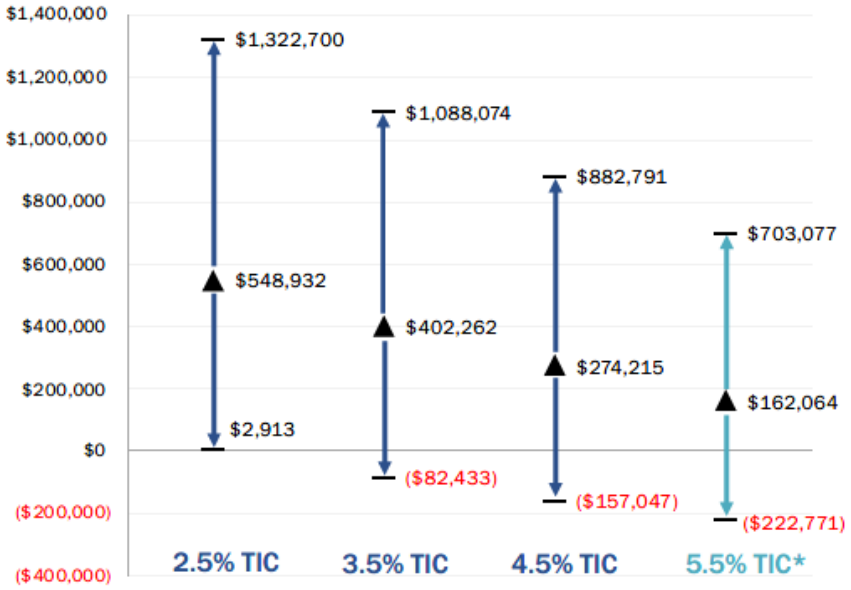
The Effect of Issuance TIC on PV of POBs

- The PV of the POB strategy varies inversely with TIC
  - Expected value of POB policy is $548,932, $402,262, $274,215, and $162,064 (per million dollars) for TICs of 2.5%, 3.5%, 4.5%, and 5.5%, respectively.
- Also, 5th percentile VaR increases with TIC
  - VaR per million dollars is $(2,913), $82,433, $157,047, and $222,771 (per million dollars) for TICs of 2.5%, 3.5%, 4.5%, and 5.5%, respectively.
- We added a fourth TIC of 5.5% to the analysis to help evaluate the potential risk associated with less-favorable future market conditions relative to those anticipated in our original report.
- Output from the new scenario provides an approximate characterization of the potential risk inherent in less favorable market conditions than those modeled in the original report.
- For example, the 5.5% TIC scenario provides output that is roughly analogous to a 4.5% TIC bond issue with market returns approximately one percentage point below those anticipated in our original analysis. The 4.5% TIC scenario can be similarly compared to the 3.5% TIC scenario output, and so on.

17

The Effect of TIC on PV of POBs

*The fourth TIC of 5.5% was added to our analysis to help evaluate the potential risk associated with less-favorable future market conditions relative to those anticipated in our original report. For example, the 5.5% TIC scenario provides output that is roughly analogous to a 4.5% TIC bond issue with market returns approximately one percentage point below those anticipated in our original analysis. The 4.5% TIC scenario can be similarly compared to the 3.5% TIC scenario output, and so on.



18

POB Probability of Success: PV > $0

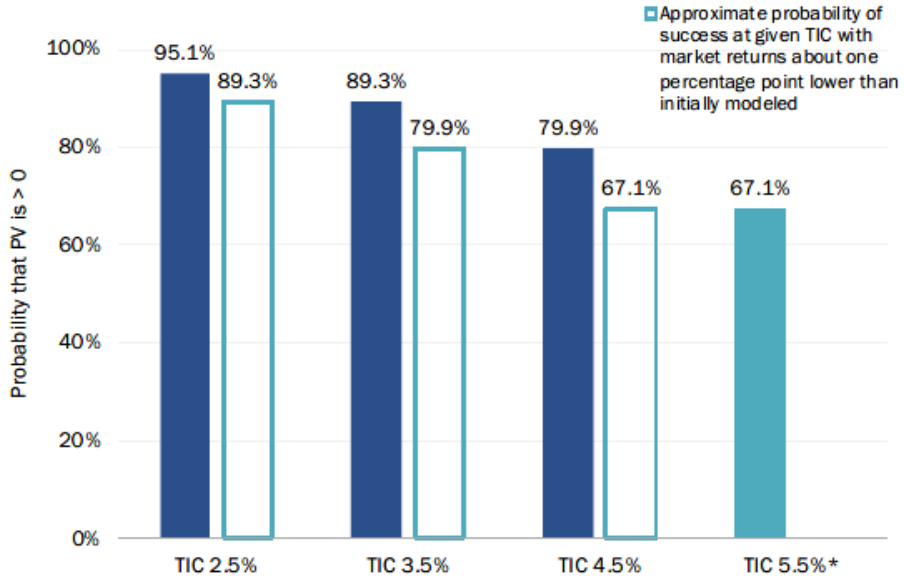
- This is another perspective on risk
  - The VaR measures the 5th percentile dollar value at risk
  - The zero bound measures the overall probability of the dollar value of the PV benefit being more than zero (i.e., success)
- Model results
  - The probability of a positive PV is lower for higher TICs
  - Probabilities of being above zero range from 67% (TIC 5.5%*) to 95% (TIC 2.5%)

*The fourth TIC of 5.5% was added to our analysis to help evaluate the potential risk associated with less-favorable future market conditions relative to those anticipated in our original report. For example, the 5.5% TIC scenario provides output that is roughly analogous to a 4.5% TIC bond issue with market returns approximately one percentage point below those anticipated in our original analysis. The 4.5% TIC scenario can be similarly compared to the 3.5% TIC scenario output, and so on.

19

Probability that PV is More than $0

*The fourth TIC of 5.5% was added to our analysis to help evaluate the potential risk associated with less-favorable future market conditions relative to those anticipated in our original report. For example, the 5.5% TIC scenario provides output that is roughly analogous to a 4.5% TIC bond issue with market returns approximately one percentage point below those anticipated in our original analysis. The 4.5% TIC scenario can be similarly compared to the 3.5% TIC scenario output, and so on.



20

Summary PV Statistics, by Scenario

*The fourth TIC of 5.5% was added to our analysis to help evaluate the potential risk associated with less-favorable future market conditions relative to those anticipated in our original report. For example, the 5.5% TIC scenario provides output that is roughly analogous to a 4.5% TIC bond issue with market returns approximately one percentage point below those anticipated in our original analysis. The 4.5% TIC scenario can be similarly compared to the 3.5% TIC scenario output, and so on.

No. of Tranches	1	1	1	1
Rate (TIC)	2.5%	3.5%	4.5%	5.5%*
Mean	$548,932	$402,262	$274,215	$162,064
Std Deviation	$419,122	$370,750	$329,071	$293,051
Maximum	$3,393,617	$2,967,149	$2,592,638	$2,262,810
Minimum	$(336,091)	$(385,105)	$(428,435)	$(466,879)
95th Perc	$1,322,700	$1,088,074	$882,791	$703,077
90th Perc	$1,104,226	$893,399	$709,810	$548,797
75th Perc	$770,245	$599,774	$450,156	$320,087
50th Perc	$480,961	$342,299	$220,903	$114,852
25th Perc	$248,540	$136,280	$38,418	$(47,779)
10th Perc	$85,882	$(8,851)	$(91,354)	$(163,865)
5th Perc (VaR)	$2,913	$(82,433)	$(157,047)	$(222,771)
Zero Bound Perc	95.1%	89.3%	79.9%	67.1%

This table summarizes the simulations of the present value of potential gains from implementing a POB strategy. All dollar amounts are per $1 million of POB funding.

21

Conclusions

- The expected value to employers of a POB strategy is positive (in present value terms)
  - The expected value is non-trivial proportion of POB funding under the scenarios modeled
  - The 5th percentile VaR is less than the expected PV in all of the scenarios modeled except for the 2.5% TIC scenario.
- However, there is a non-trivial probability that the present value of POBs is zero or less, and the probability increases with TIC
- Important considerations for individual employers
  - The issuance TIC
  - Some issuance costs are not included in TIC
  - Whether the employer's payroll growth rate is the same as currently assumed by the PERS actuary

Acknowledgements, Caveats, and Disclaimers

The authors wish to acknowledge the kind assistance of Mike G Mueller of the Oregon State Treasury, Investment Division for their kind assistance, and for Callan and Associates staff's generous provision of capital market assumptions. We also wish to thank Carol Samuels of Piper Sandler & Co. for her assistance in providing insight into muni market conditions. Finally, a note of gratitude to Carl Batten, original developer of the ECONorthwest POB model, for his ongoing assistance with subsequent iterations of the model, including the version used in this analysis. None of the statements or analysis herein should be attributed to anyone other than ECONorthwest staff.

The analysis provided in this document was developed by ECONorthwest for informational purposes only. All possible professional care was taken to prepare a realistic emulation of the likely POB side account behavior, and the OPERS procedures for accommodating POBs. State of the art modeling and statistical software was employed in this exercise. It should be recognized, however, that there are practical limits to the precision with which market and agency behavior can be modeled. The generic nature of the modeling performed may or may not be relevant to the circumstances of any one public employer. Additionally, nothing herein should be construed as offering investment advice or fairness opinions for the purpose of issuing securities. For this, interested parties should seek out professional counsel.

This analysis takes the narrow perspective of measuring the potential benefits of POB issuance to current employers and taxpayers. Whether use of pension obligation bonds is good public policy is a matter of professional debate and is not addressed herein.

This analysis was prepared to assist issuers of POBs in understanding the risks and returns of POBs under hypothetical conditions. Individuals should seek professional guidance concerning the relevance of this analysis to their circumstances.

ECONorthwest

ECONOMICS • FINANCE • PLANNING

Los Angeles

Portland

Seattle

Boise