Constructing Dedicated Portfolio against District Bond Obligations from a Simplified Scenario

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Outline

- Introduction
- Objectives & Deliverables
- Approaches & Research Accomplished
- Conclusion & Future Recommendations

My sponsor

Stone & Youngberg is a division of Stifel Nicolaus & Company and is a leader in municipal finance in the Far West, with roots in California dating back to 1931. Its parent company, Stifel Nicolaus & Company, has been providing investment services nationally since 1890 and, today, remains one of the few independent, full-service, securities-related financial services firms in the country.

Stone & Youngberg works with state and local governments, school districts and non-profit agencies to strengthen local communities.

Background

Poway Unified School District is a school district located in Poway, California.

Last year, it borrowed 105 million dollars from investors by selling a bond to either payoff previous debts and upgrade infrastructures.
Taxpayers in the area will end up with a nearly 1 billion bill at the end of this deal.

In the next two decades, taxpayers in the Poway district will have to start paying about 50 million a year to cover the total bill

Problems

the district could have authorized more taxes from taxpayers to pay for the interests from the bond, but it would break down the promises they made to the community and the connection with it

Poway school district decided to employ other means and has sought help from Stone & Youngberg

Stone & Youngberg has come up with a strategy to construct a dedicated portfolio that can generate future cash flow to satisfy Poway's future financial obligations

Objectives

In this project, we will try to select the appropriate assets at a minimum cost but with maximum degree of matching , then find the optimal proportion of each asset

Deliverables

The R packages of present value calculations of liability stream

The list of assets in portfolio

The Excel spreadsheet of asset proportion calculations

The performance of our portfolio

Dummy Data

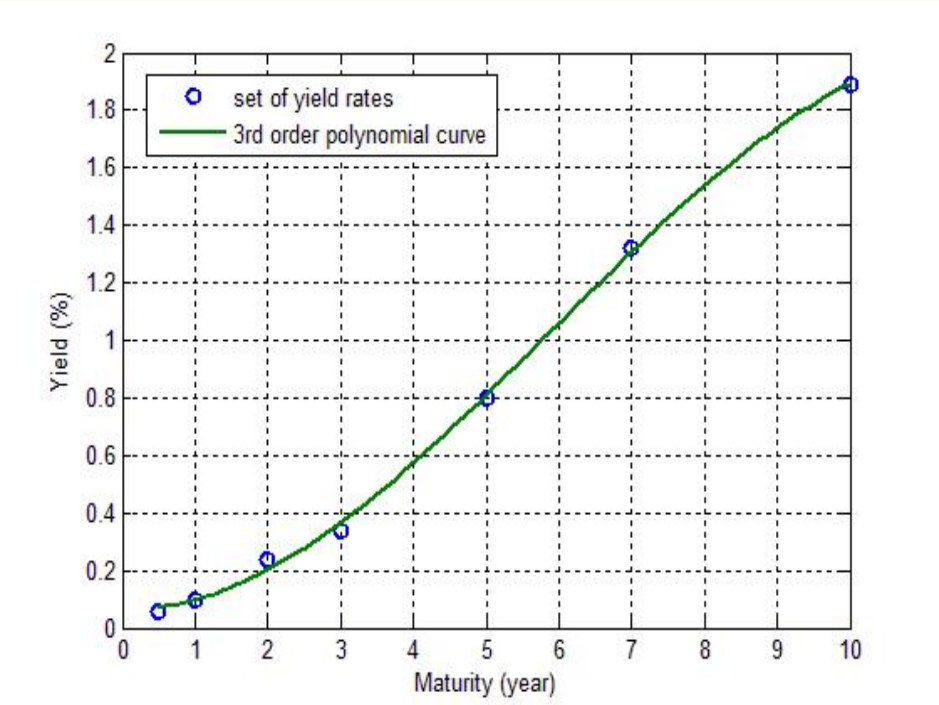
Date	Liability	Date	Liability
7/15/2012	6	7/15/2016	8
1/15/2013	6	1/15/2017	8
7/15/2013	9	7/15/2017	8
1/15/2014	9	1/15/2018	8
7/15/2014	10	7/15/2018	6
1/15/2015	10	1/15/2019	6
7/15/2015	10	7/15/2019	5
1/15/2016	10	1/15/2020	5

Table: Liability Stream.

Calculating present value of the liability stream

- Polynomial
  Polynomial regression is a form of linear regression in which the relationship between the independent variable x and the dependent variable y is modeled as an nth order polynomial.

  We used seven yield rates between 6 months and 10 years, 3rd order polynomial curve



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Calculating present value of the liability stream

- Bootstrapping
  First we compute the discount factor. The basic idea of bootstrapping is like this,

$$P = C(t_1) \times d(t_1) + C(t_2) \times d(t_2) \quad (1)$$

  Once we have d(t1), from the equation, we will get d(t1) and d(t2), etc. After we compute the discount factors, we compute the present value of each liability .

Calculating present value of the liability stream

Date	Liability	PV from Polynomial	PV from Bootstrap
7/15/2012	6	6.00	6.00
1/15/2013	6	5.99	5.99
7/15/2013	9	8.98	8.98
1/15/2014	9	8.96	8.96
7/15/2014	10	9.93	9.93
1/15/2015	10	9.89	9.90
7/15/2015	10	9.84	9.86
1/15/2016	10	9.77	9.79
7/15/2016	8	7.76	7.76
1/15/2017	8	7.68	7.68
7/15/2017	8	7.60	7.59
1/15/2018	8	7.51	7.49
7/15/2018	6	5.56	5.55
1/15/2019	6	5.48	5.47
7/15/2019	5	4.50	4.49
1/15/2020	5	4.43	4.43
sum	124	119.9	119.86

Table: Liability Stream.

Asset Allocation

we will choose around 30 assets to construct a portfolio to fulfill our future liability obligations. The assets are a pool of Treasury notes with different maturities.

Reasons:

- Credit Risk
  Governmental bonds ensures that all obligations will be fulfilled without concerned of default risks.

Asset Allocation

- Interest Risk
  We choose bonds with fixed payments to eliminate TIPS

- Payment Matching
  Our assets should pay semi-annually. To solve the problem that there is no matching bond on the exact days, we choose T-notes with maturity BEFORE the exact payment dates.

Asset Allocation

T-NOTE 30/06/12	T-NOTE 30/11/14	T-NOTE 31/05/17
T-NOTE 15/07/12	T-NOTE 31/12/14	T-NOTE 30/06/17
T-NOTE31/12/12	T-NOTE 31/05/15	T-NOTE 30/11/17
T-NOTE 15/01/13	T-NOTE 30/06/15	T-NOTE 31/12/17
T-NOTE 30/06/13	T-NOTE 30/11/15	T-BOND 31/05/18
T-NOTE 15/07/13	T-NOTE 31/12/15	T-NOTE 31/05/18
T-NOTE 15/12013	T-NOTE 31/05/16	T-BOND 15/11/18
T-NOTE 31/12/13	T-NOTE 30/06/16	T-NOTE 15/11/18
T-NOTE 31/05014	T-NOTE 30/11/16	U S TREAS SEC 15/05/19
T-NOTE 30/06/14	T-NOTE 31/1216	T-NOTE 15/05/19
		U S TREAS SEC 15/11/19

Table: Assets

What we have done

1. Calculated the present value of the liability stream using polynomial regression and bootstrapping methods
2. Selected 32 T-notes as our portfolio assets

We are almost halfway there.....

What to do next

How to construct the portfolio?

We want to make sure:

1. Our initial investment and the excess cash from each period will be minimized.
2. Duration, convexity and present value of the bond portfolio are equal to those of the liability stream.

Recommendations:

Use Excel to set up a Linear Program

Use Immunization Theory to compare the duration and convexity

Thanks for Watching!