NORTHFIELD | modeling financial markets worldwide

Household Optimization for Private Wealth and Family Offices

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August Online Workshop

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Presentation Goals

- Demonstrate a practical implementation of Northfield's new multiple account household optimization methodology
- An extension of the research webinar installation on the same topic last year: http://www.northinfo.com/documents/893.pdf
- Review background concepts of householding
- Describe the methodology that has been implemented into the Open Optimizer
- Work through a use case in the optimizer with discussion of constraints

Householding Description

- Broadly defined, any group of related accounts with overlap in investment goals but heterogeneity in composition of subaccounts

- This can range from a single investor with two accounts (a taxable account and a tax-deferred retirement account), to a family office with dozens of accounts, funds, and trusts.

- Our householding methodology is most useful to balance the **common investment goal** of the investor or investor group with the **synergies** introduced from taking advantage of the heterogeneity of the different accounts.

Householding Description

- The common investment goal can be thought of as an aggregate benchmark for the members of the household, which can be any mix of assets: an asset allocation, a mix of holdings from active managers, traditional benchmarks, etc.

- The three key differences across members of a household
  - **Legacy holdings**: embedded losses and gains
  - **Tax circumstances**: different tax rates for different members of the household and different accounts, common tax bills for spouses
  - **Investor preferences**: which accounts can hold which assets

Householding before householding

- Two suboptimal options:

- Optimize everything as one big portfolio
  - Optimal for the household, suboptimal for the individual
  - Doesn't easily allow for different tax rates or subdivision of assets, although there are ways to set up sleeves and some tax customization

- Optimize each account separately
  - Optimal for the individual, suboptimal for the household
  - Can be very specific, but does not gain efficiency from looking across accounts that could "smooth" unintentional bets or increase tax efficiency

Household Optimization Mechanics

- Reminder of how we optimize one account:

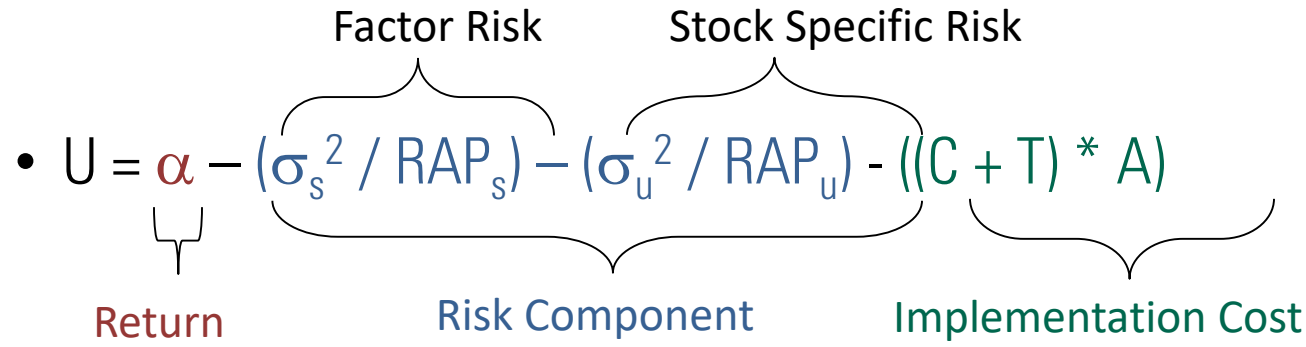
Optimization Objective Function

- Investor objective is to maximize risk- adjusted returns net of costs:

$$\text{Utility} = \text{Return} - \text{Risk} - \text{Costs}$$

  - Most commercial portfolio optimizers uses the objective function described in Levy and Markowitz (1979)
  - Portfolio return variance is the proper measure of risk because the difference between the arithmetic average rate of return and the geometric average rate of return is proportional to the variance (see Messmore, 1995)

Objective Function Explained



- α = the "certainty equivalent" expected portfolio return
- σ_s^2 = portfolio variance risk due to common factors (correlation across securities)
- σ_u^2 = portfolio variance risk due to stock specific risks
- RAP = risk tolerance
- C = transaction costs for the optimization
- T = capital gain taxes for the optimization
- A = amortization constant

Note that this is a convex function and the various scalars transform all terms into certainty equivalent expected return units

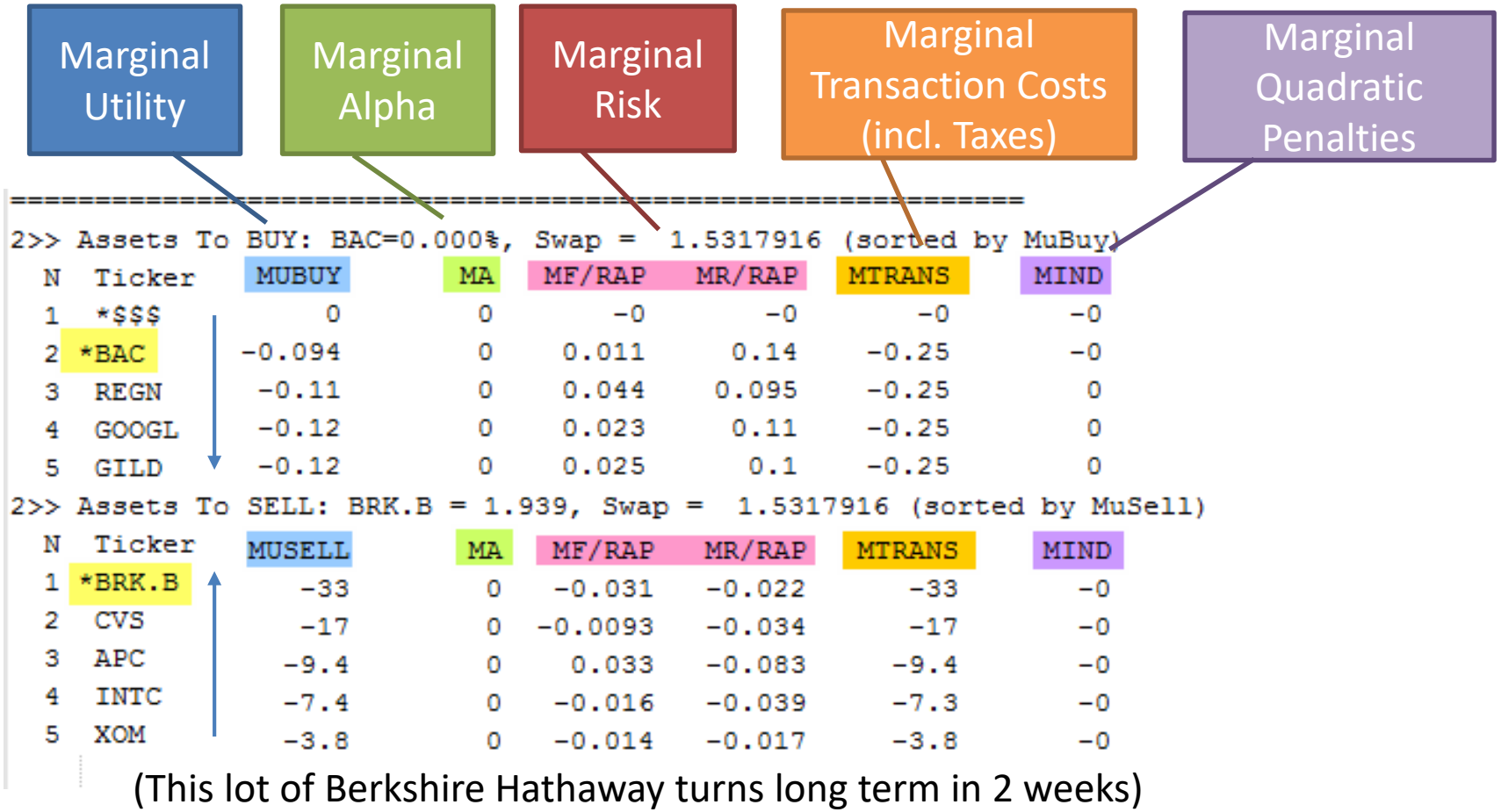
An Optimization in Steps

- Our goal is to adjust the security weights to maximize the objective function, given your input settings.

- Northfield uses a Pairwise Swap Gradient method.
  This means:
  - Buy a little of the best asset, sell a little of the worst asset.
  - Repeat until you can't trade any more or make any more improvements.

An Optimization in Steps

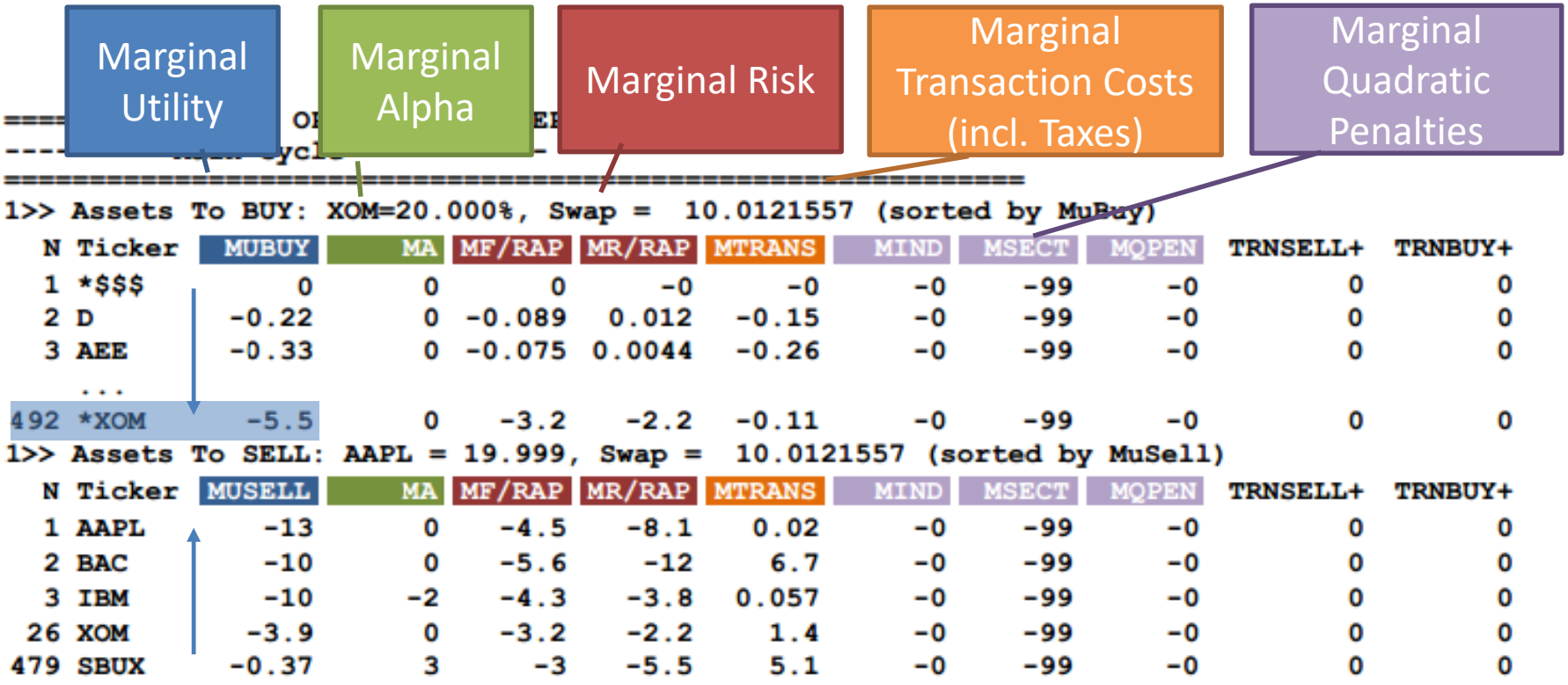
- Buy the Bank of America for risk, sell Berkshire for taxes:



(This lot of Berkshire Hathaway turns long term in 2 weeks)

An Optimization in Steps

- Buy the best asset, sell the worst asset. Skip any trade that would violate a constraint.



1>> Assets To BUY: XOM=20.000%, Swap = 10.0121557 (sorted by MuBuy)

N	Ticker	MUBUY	MA	MF/RAP	MR/RAP	MTRANS	MIND	MSECT	MQPEN	TRNSELL+	TRNBUY+
1	*$$$	0	0	0	-0	-0	-0	-99	-0	0	0
2	D	-0.22	0	-0.089	0.012	-0.15	-0	-99	-0	0	0
3	AEE	-0.33	0	-0.075	0.0044	-0.26	-0	-99	-0	0	0
...											
492	*XOM	-5.5	0	-3.2	-2.2	-0.11	-0	-99	-0	0	0

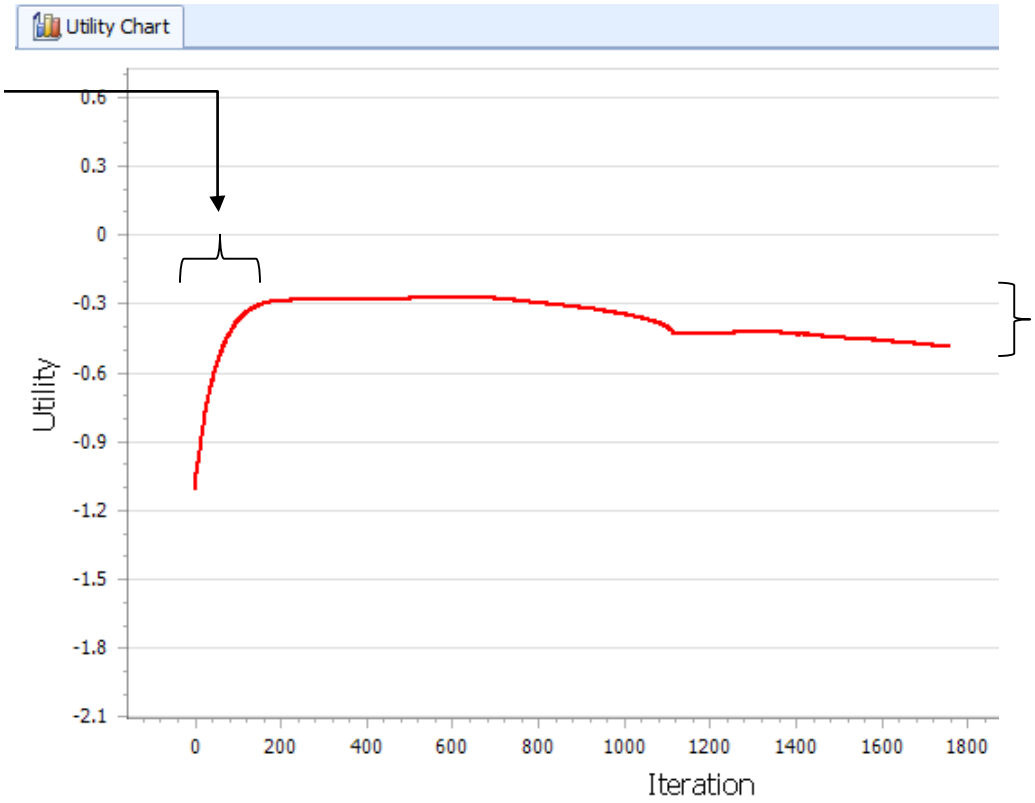
1>> Assets To SELL: AAPL = 19.999, Swap = 10.0121557 (sorted by MuSell)

N	Ticker	MUSELL	MA	MF/RAP	MR/RAP	MTRANS	MIND	MSECT	MQPEN	TRNSELL+	TRNBUY+
1	AAPL	-13	0	-4.5	-8.1	0.02	-0	-99	-0	0	0
2	BAC	-10	0	-5.6	-12	6.7	-0	-99	-0	0	0
3	IBM	-10	-2	-4.3	-3.8	0.057	-0	-99	-0	0	0
26	XOM	-3.9	0	-3.2	-2.2	1.4	-0	-99	-0	0	0
479	SBUX	-0.37	3	-3	-5.5	5.1	-0	-99	-0	0	0

An Optimization in Steps

This method produces intuitive, tractable optimization paths that closely mimic a trader's methodology.

Trades with the most impact on the portfolio happen first.



Makes understanding the magnitude of costs of certain constraints obvious

Adding on the logic for householding

Logic for multiple account optimizations:

We identify the best trade **for each account**, and make the best trade across all accounts

An Optimization in Steps

Account 1

2>> Assets To BUY: BAC=0.000%, Swap = 1.5317916 (sorted by MuBuy)

N	Ticker	MUBUY	MA	MF/RAP	MR/RAP	MTRANS	MIND
1	*$$$	0	0	-0	-0	-0	-0
2	*BAC	-0.094	0	0.011	0.14	-0.25	-0
3	REGN	-0.11	0	0.044	0.095	-0.25	0
4	GOOGL	-0.12	0	0.023	0.11	-0.25	0
5	GILD	-0.12	0	0.025	0.1	-0.25	0

2>> Assets To SELL: BRK.B = 1.939, Swap = 1.5317916 (sorted by MuSell)

N	Ticker	MUSELL	MA	MF/RAP	MR/RAP	MTRANS	MIND
1	*BRK.B	-33	0	-0.031	-0.022	-33	-0
2	CVS	-17	0	-0.0093	-0.034	-17	-0
3	APC	-9.4	0	0.033	-0.083	-9.4	-0
4	INTC	-7.4	0	-0.016	-0.039	-7.3	-0
5	XOM	-3.8	0	-0.014	-0.017	-3.8	-0

Account 2

2>> Assets To BUY: BAC=0.000%, Swap = 1.5317916 (sorted by MuBuy)

N	Ticker	MUBUY	MA	MF/RAP	MR/RAP	MTRANS	MIND
1	*$$$	0	0	-0	-0	-0	-0
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Account 3

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5	XOM	-3.8	0	-0.014	-0.017	-3.8	-0

Account 4

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An Optimization in Steps

The heterogeneity of different accounts in tax rates, cost bases alpha, and constraints ensures that preferences are adhered to, asset location can be automated, and tax bill is minimized.

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Working through a use case

Married couple, filing jointly with five accounts

Account	Tax Status	% of Total	Description
1	Taxable	28%	Legacy account spouse 1, growth preference
2	Non-Taxable	7%	IRA Retirement account
3	Taxable	15%	Recently liquidated asset that created a large capital gain
4	Non-Taxable	2%	529 for 3 year old child
5	Taxable	48%	Legacy account spouse 2, value preference

Working through a use case

Joint asset allocation

US Growth Model (Active)	25
US Value Model (Active)	33
Small Cap Fund	5.7
Mid Cap Fund	5.7
Equity US Small Cap Growth	4
Equity US Small Cap Value	3.6
Int'l Developed Equity	5
Int'l Emerging Equity	13
Municipal Bond Fund	2.5
Fixed Income Fund	2.5

Working through a use case

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Fixed Income Fund	2.5

Asset **location** consideration

- Spouse 1's growth preference
- Spouse 2's value preference

Working through a use case

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Municipal Bond Fund	2.5
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Asset **location** consideration

- Good for taxable accounts

Working through a use case

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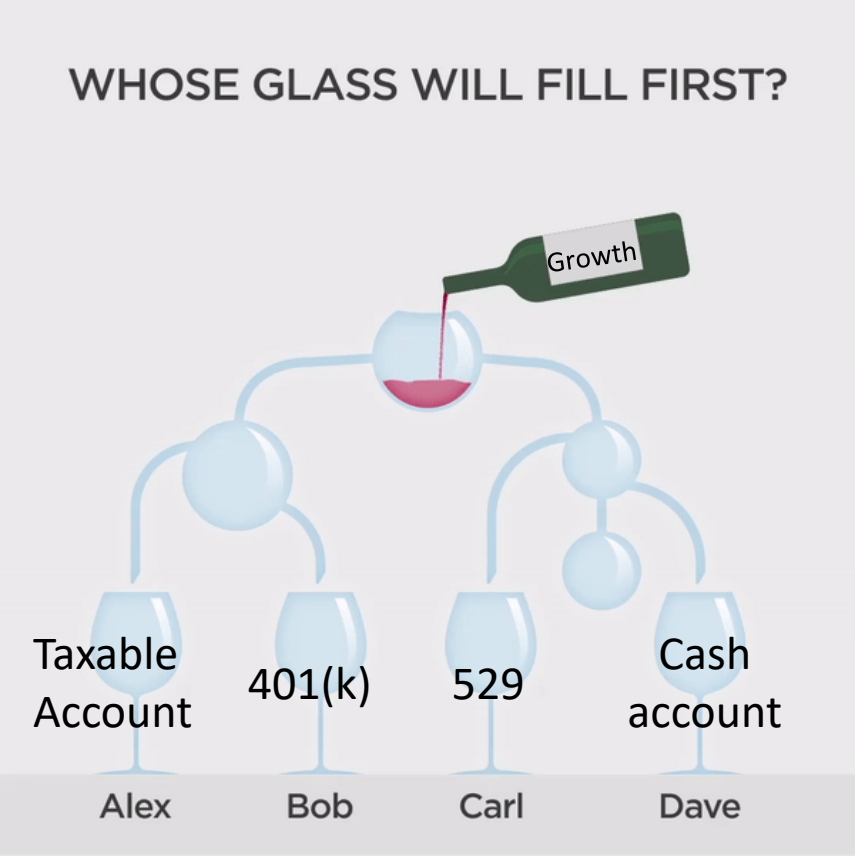
Int'l Emerging Equity	13
Municipal Bond Fund	2.5
Fixed Income Fund	2.5

Asset **location** consideration

- Care more about security bets
- Care more about factor bets

Constraints solve these problems



5	3			7				
6			1	9	5			
	9	8					6	
8				6				3
4			8		3			1
7				2				6
	6					2	8	
			4	1	9			5
				8			7	9

Constraints solve these problems

- Constraints can now be set at the account level and/or the household level
- Constraints can be “should” constraints, like different alphas for the same security if it is held in a taxable or tax-deferred account to take into account after-tax returns (wine bottle puzzle)
- Constraints can be “must” constraints, like disallowing munis from being held in tax-deferred accounts (Sudoku puzzle)

Conclusion

- Contact information:
  sdyer@northinfo.com
  support@northinfo.com

- Further reading:

  Methods for Joint Optimization of Multiple Related Portfolios: Householding and Beyond
  Event Recording:
  https://northinfoevents.webex.com/northinfoevents/lsr.php?RCID=99648a692f7a39ac6af10b4cb6567894

  Slides: http://www.northinfo.com/documents/893.pdf

  Tech Tip: Constraints in Householding Optimizations https://www.northinfo.com/Documents/901.pdf