

**Better investing
through
technology**

Betterment

Fintech is a big space

Marketplace Lending



Direct Lending & Underwriting



Bill Pay / Money Transfer



Investment Management



Online/Mobile Banking



Personal Finance



Robo-advisor



Fintech is a big space

Marketplace Lending



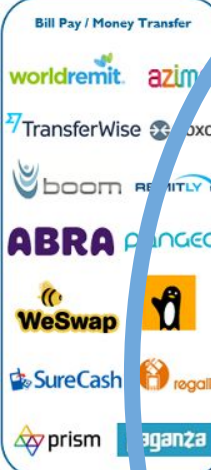
SoFi Upstart PROSPER
Lufax.com 九信金融 harmoney
点融网 auxmoney 翼龙贷
CommonBond JIMU 积木盒子
人人贷 美利金融 网利宝
prêt d'union Rate%Setter Zopa
信而富 LendInvest smava
peerform fruitful Bondora
LENDING WORKS Borrowell EVEN FINANCIAL
LANDBAY Lendify

Direct Lending & Underwriting



AVANT Credit Karma Kreditech
earnest borro LendUp wonga
mimoni Lenddo sindeo inVenture
progressa Grow. BACKED ES

Bill Pay / Money Transfer



worldremit azim
TransferWise
boom
ABRA
WeSwap
SureCash regall
prism ganza

Investment Management



moif INVESTING etoro
PERSONAL CAPITAL
robinhood DriveWealth
STOCKPILE STASH
Aspiration KAPITALL
bloom 懒投资

Created By



CB INSIGHTS

Online/Mobile Banking



Atom nu bank NUMBER26 KOHO osper one financial
rocketbank monya monese mondo Moven Zenbank

Personal Finance



Money Forward 我的资产管家 GuiaBolso tink zaim
planwise CAPITAL Perfios LEVANTO FINANCIAL WEALTHTANK

Robo-advisor



Betterment wealthfront
SIGFIG Hedgeable
CASHBOARD acorns
Nest WEALTH Wealthsimple
WiseBanyan

Fintech is a big space

Marketplace Lending



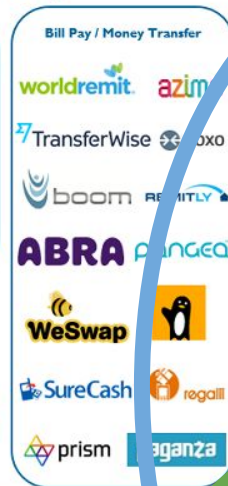
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人人贷 美利金融 网利宝
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Robo-advisor



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WiseBanyan

Robo-advisor

“provides financial advice or investment management online with moderate to minimal human intervention. They provide digital financial advice based on mathematical rules or algorithms, executed by software.”

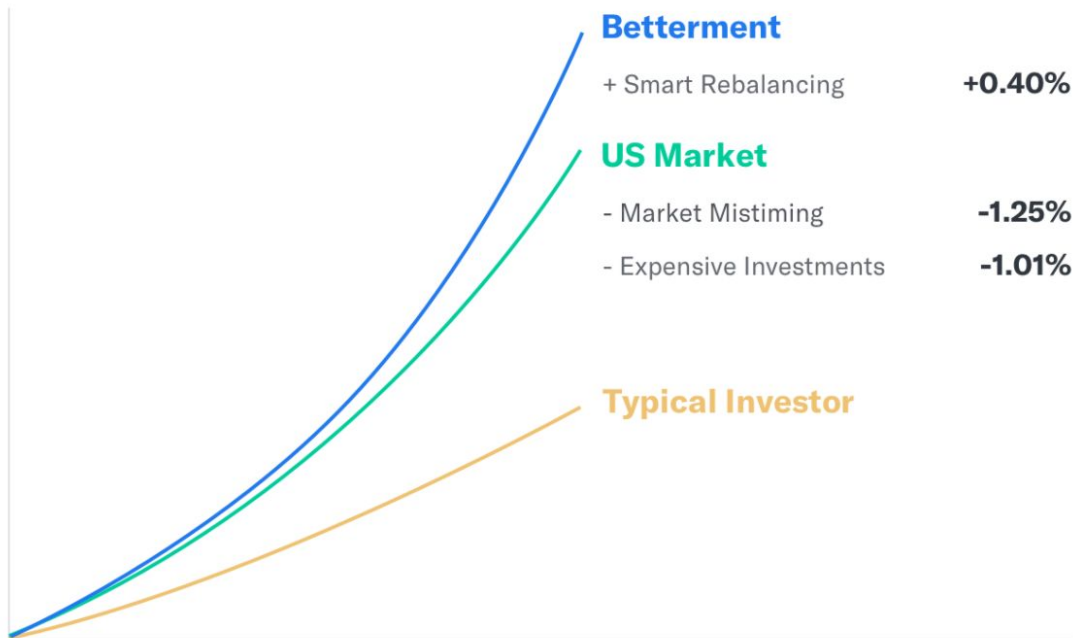
Betterment



Automated, online financial advising platform

- Goal-based advice and investment management
- Higher returns at a lower cost by using technology to automate optimal investing practices

In a nutshell

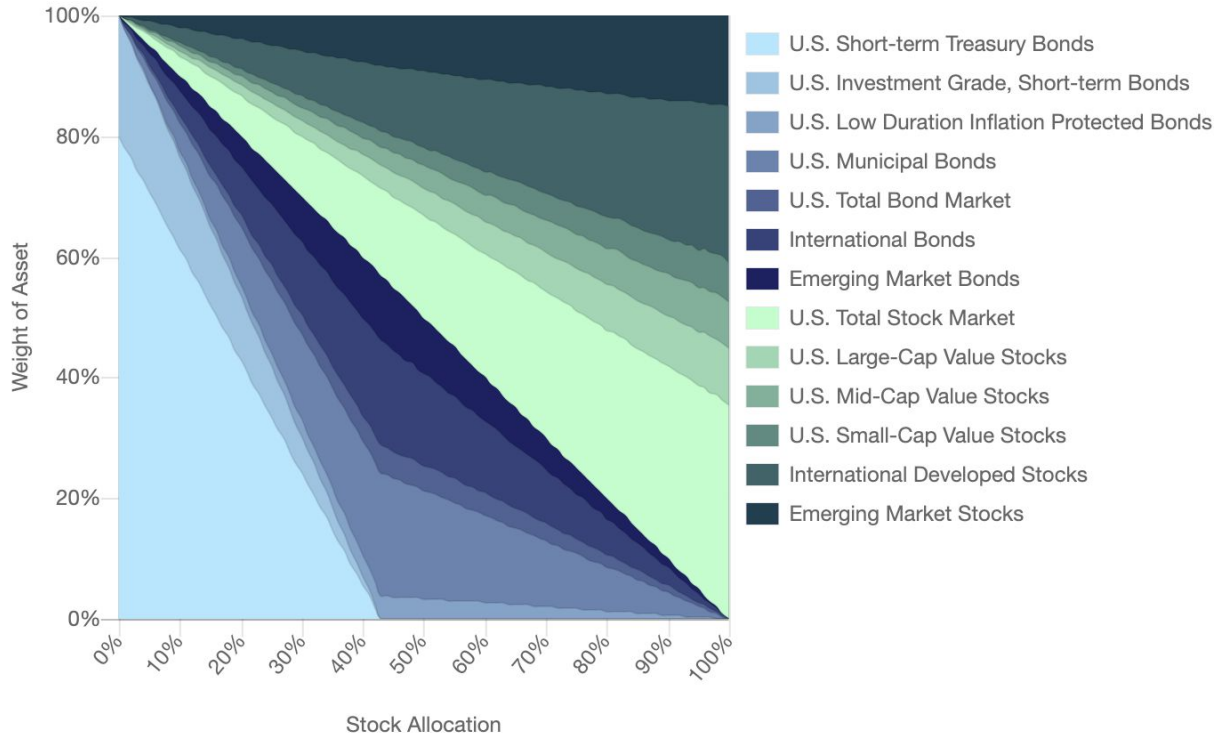


Better investing outcomes through:

- Low costs
- Diversified portfolio
- Smart portfolio management
- Tax optimization
- Good investing behavior

We construct optimal investment portfolios

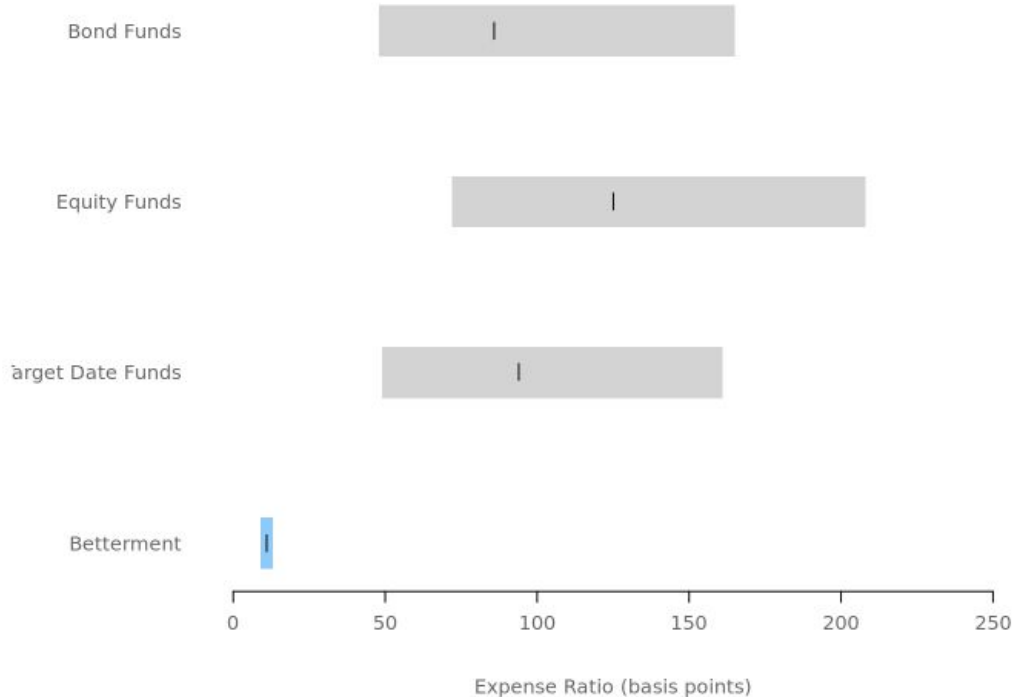
Asset Class Weight at Every Allocation



- Global portfolio of stocks and bonds
- Managed algorithmically

We keep costs low

Mean and range of fund cost:



- Low-cost broad index ETFs
- Portfolio expense ratios: 7bps - 17bps
- Technology keeps Betterment's management fee low: 25bps

We keep taxes low

Additional Returns with Tax Loss Harvesting+

Backtested performance with tax savings reinvested, 2000-2013



- ETFs vs Mutual Funds
- Sell the right lots (FIFO vs smart management)
- Smart rebalancing
- Tax Loss Harvesting
- Asset location

We provide investment advice

Risk
Moderate [?](#)



[See current holdings](#)

[Why goal-based investing? >](#)

[Why this stock allocation? >](#)

[About our projections >](#)

Recommended

[Age 66](#)

Recommended

[\\$591.72](#)

Recommended

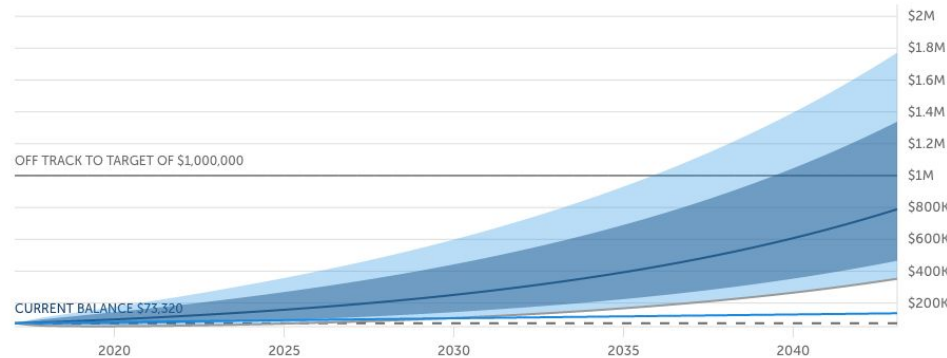
[\\$55,748.00](#)

AVERAGE MARKET PERFORMANCE

\$788,826

POOR MARKET PERFORMANCE

\$352,200



- Goal-based advice to reach desired financial outcomes
- Recommended saving amount
- Recommended risk level

We promote good behavior




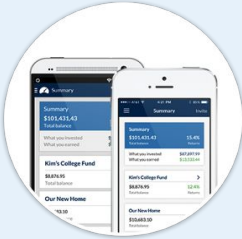
- Smart defaults
- Automated rebalancing
- Using investor biases for good
- Goal-based

We do this across multiple lines of business

Retail Market


Betterment
INVESTING MADE BETTER®



Clients

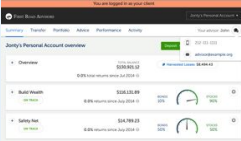


RIA Market

Betterment
INSTITUTIONAL



Clients



Advisors

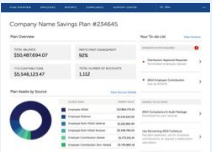


401(k) Market

Betterment
FOR BUSINESS


Participant


Plan sponsors



Betterment Platform

History of technology in financial services

(Told with a brief analogy)



Experts behind screens



✗ Limited capacity

✗ Potential for errors manual, mechanical, and redundant processes.

✓ Can solve complicated problems.

Guided and self-directed



Machines are better

- Rule-based decisions
- Calculations at scale
- Data aggregation and retrieval

Ex: flight check-in

Humans are better

- Complex decisions
- Abstract thought
- Flexibility in logic and inputs

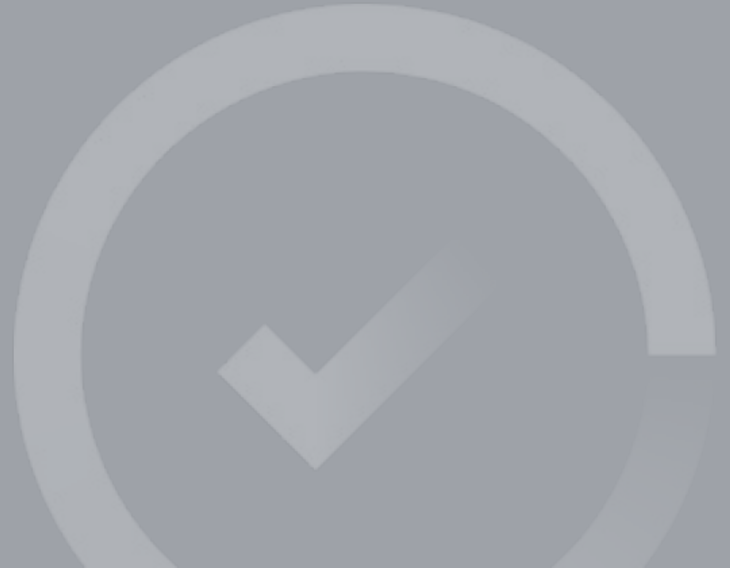
Ex: lost bag

**Get customers comfortable
interacting with machines (UX)**

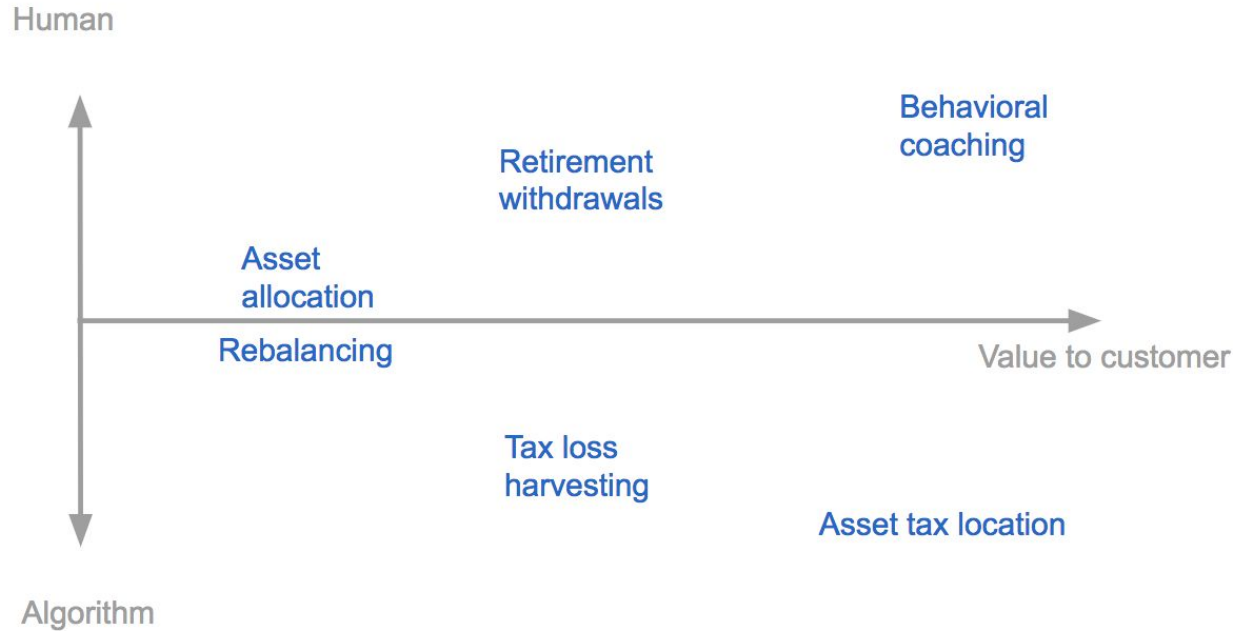
Financial planning is not flight check-in

- What can be self-directed?
- What can be automated?
- What requires expert guidance?
- How to deal with complexity
 - Financial complexity
 - Human/behavioral complexity

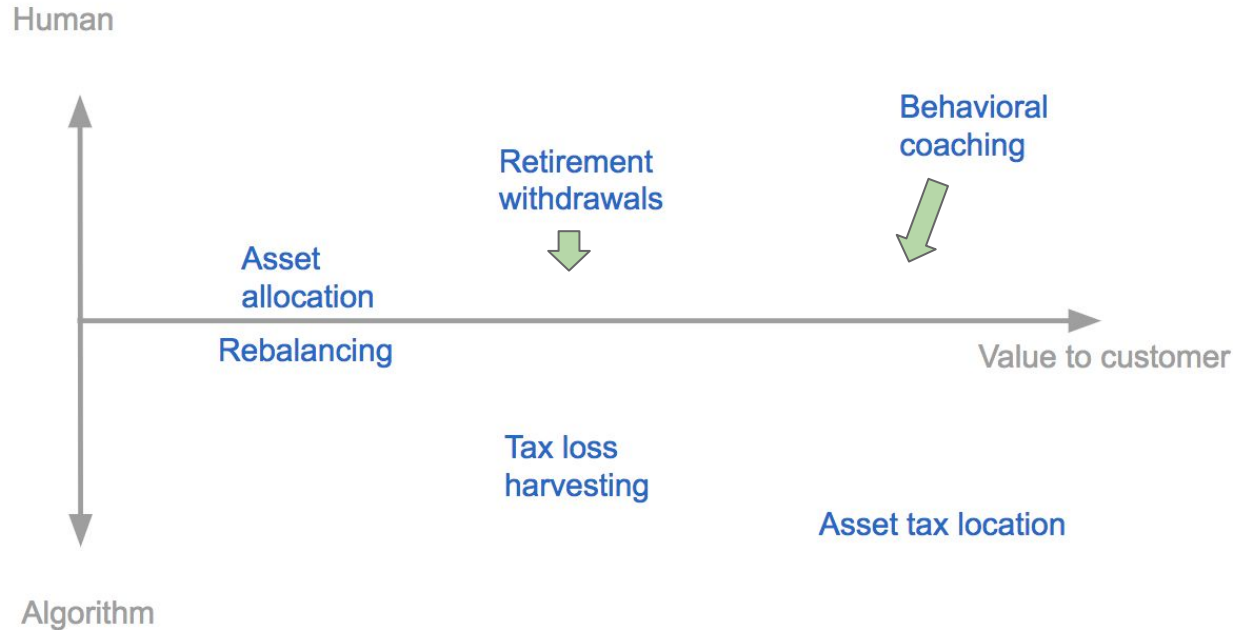
Adding technology to investment management



Spending time efficiently



The line is moving over time



Optimize returns net of fees, taxes, and behavior. Technology can help.

Portfolio Returns

- fees

- taxes

- behavior

Investor Returns

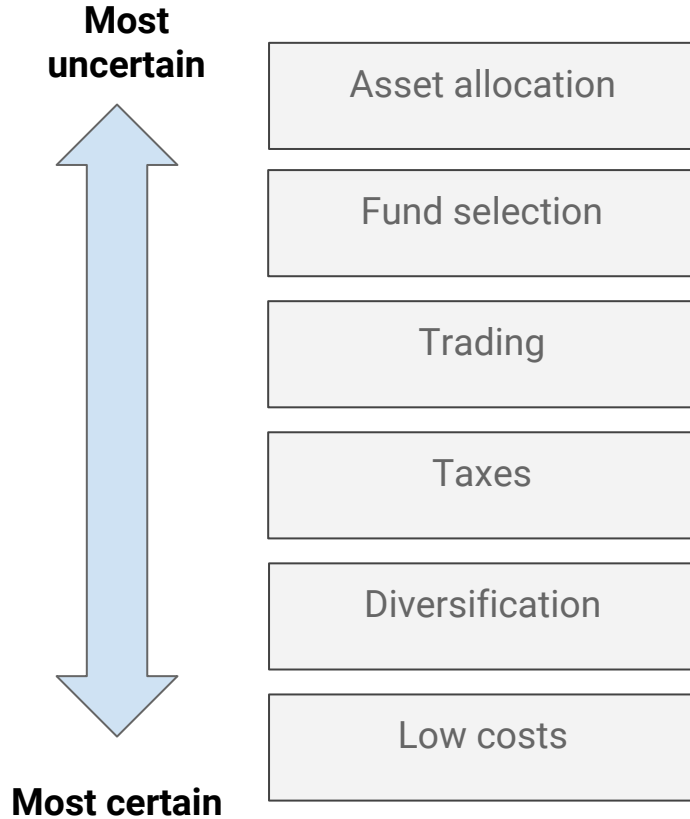
How we think about investing



Evidence-based investing

- Markets are unpredictable
 - Find other free lunches
 - Diversification
 - Lower taxes
- Computers can do many things better (and cheaper) than humans
 - Rebalancing
 - Tax strategies
- Reduce mistakes
 - Automation
 - Smart defaults / notifications

Hierarchy of Outperformance



Optimize what you can, obsess over what you control

Markets are unpredictable

- Diversify globally
- Lower taxes

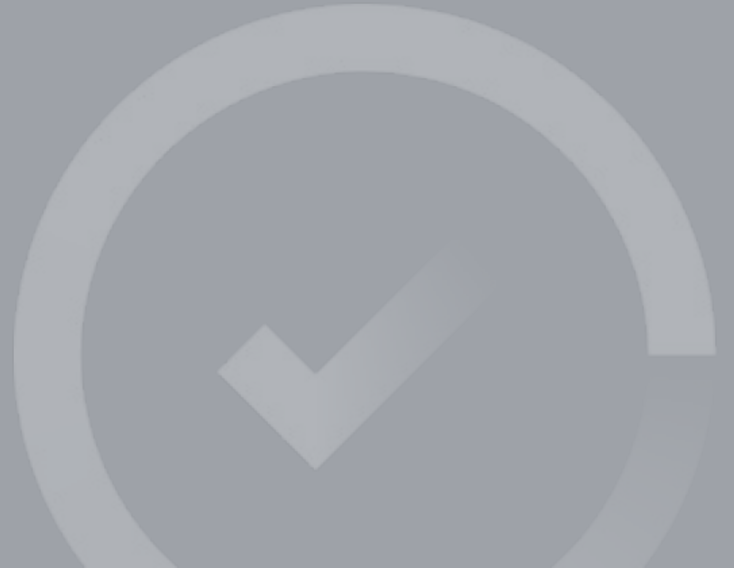
Computers can do many things better (and cheaper) than humans

- Rebalancing
- Tax strategies

Reduce mistakes

- Automation
- Smart defaults / notifications

Optimize for Portfolio Returns



Optimize returns net of fees, taxes, and behavior

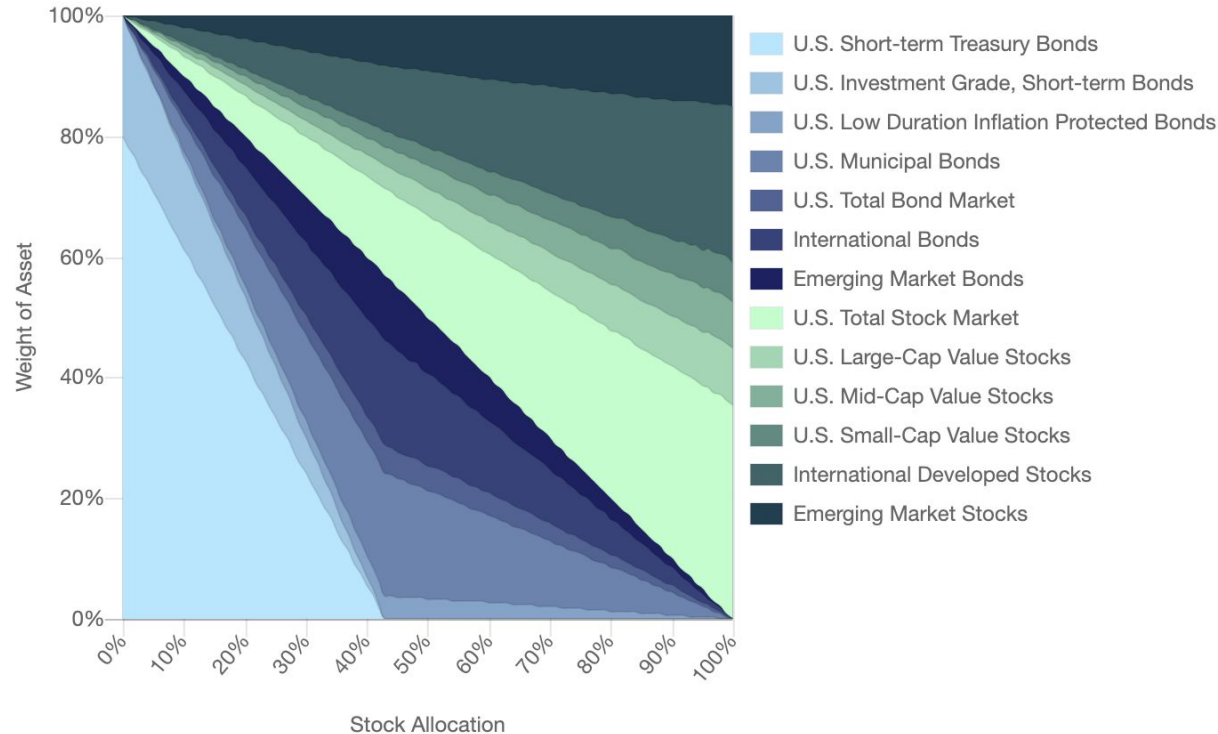
Portfolio Returns

- fees
- taxes
- behavior

Investor Returns

Globally optimal asset allocation

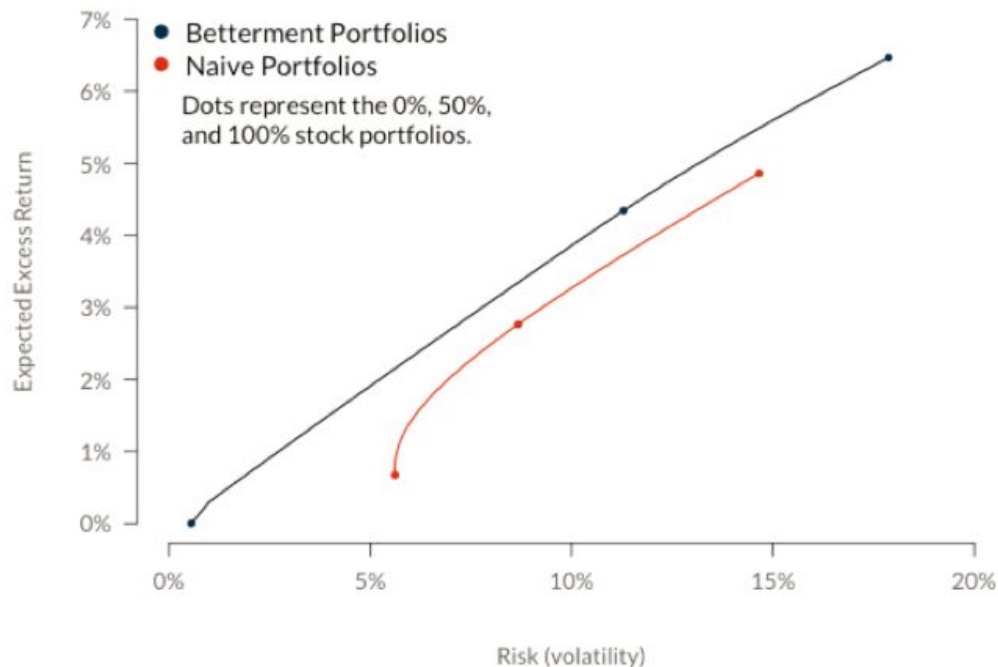
Asset Class Weight at Every Allocation



- Asset returns based on equilibrium pricing and empirical evidence
- Built for maximum diversification

Starting with a mean variance framework

Expected risk and return



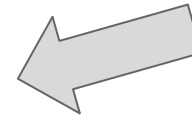
In reality, MVO is *very* sensitive to its inputs

Real world problems

- We don't know **future returns** or **future volatility** with very much certainty
- Small changes in estimates of returns will have a **big impact** on resulting portfolios

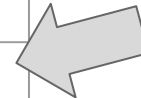
MVO as an error maximizer

		Portfolio 1	Portfolio 2
	St. Dev	E[r]	E[r]
US Stocks (SPY)	15.5%	5%	5.5%
Int'l Stocks (VEA)	19.4%	6.8%	6.8%
US Bonds (AGG)	4.0%	0.6%	0.6%



0.5% change in expected returns

	Portfolio 1	Portfolio 2	Change
	Weights	Weights	
US Stocks (SPY)	12.6%	58%	45.4%
Int'l Stocks (VEA)	67.5%	32.7%	-34.8%
US Bonds (AGG)	19.9%	9.3%	-10.6%



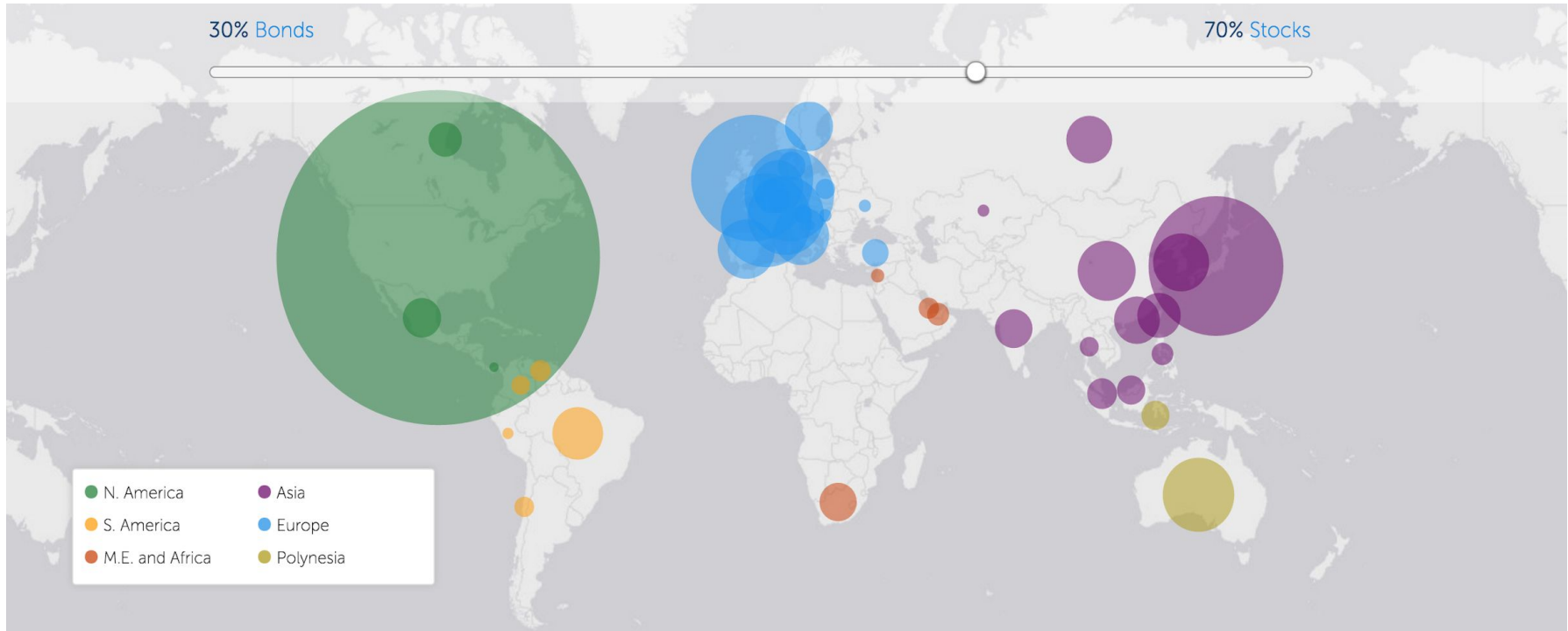
Massive shift towards US stocks

There are a number of solutions

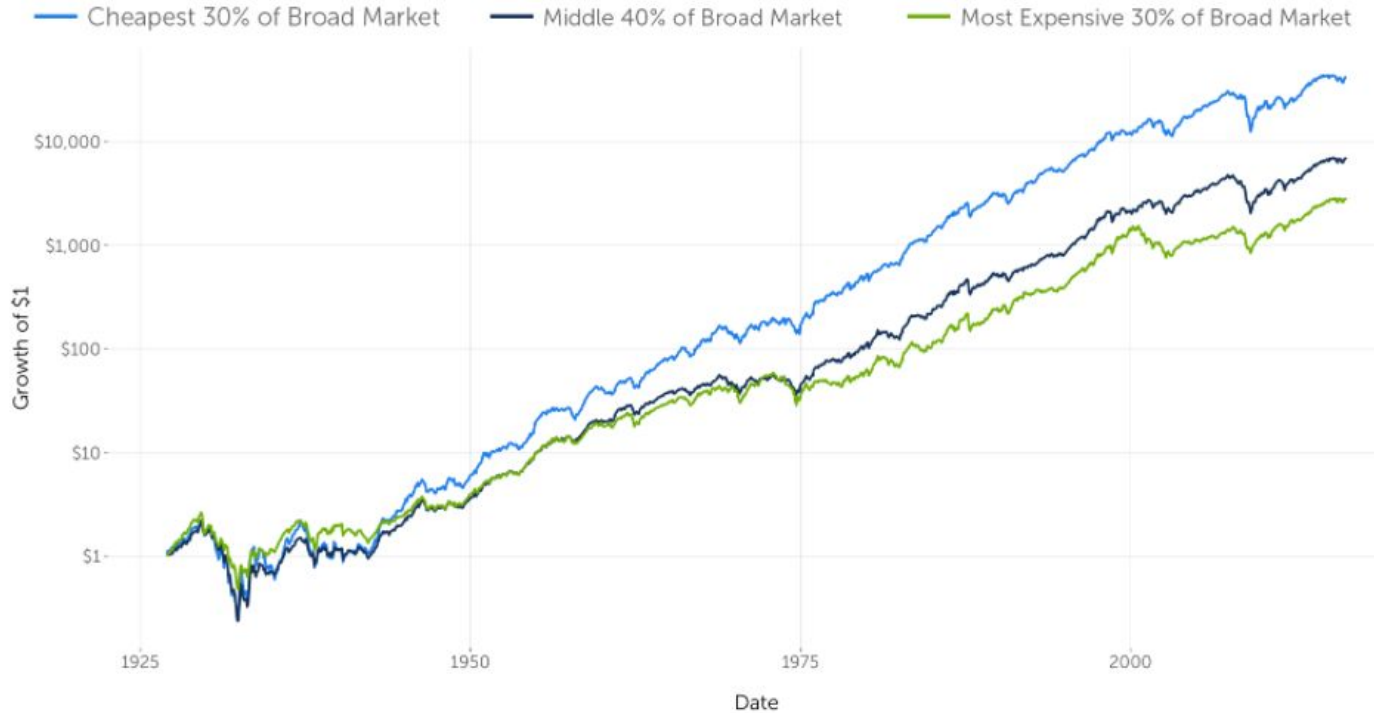
- Asset and group constraints
 - Eg:
 - Less than 10% weight in any single security
 - Less than 20% weight in any sector/region/etc
- Black-Litterman
 - Assume the market portfolio has the correct returns
 - Then combine with your own view
- Robust optimization
 - Add error into your optimization and run a bunch of times

Weights anchored to the global market portfolio

Global allocation of assets



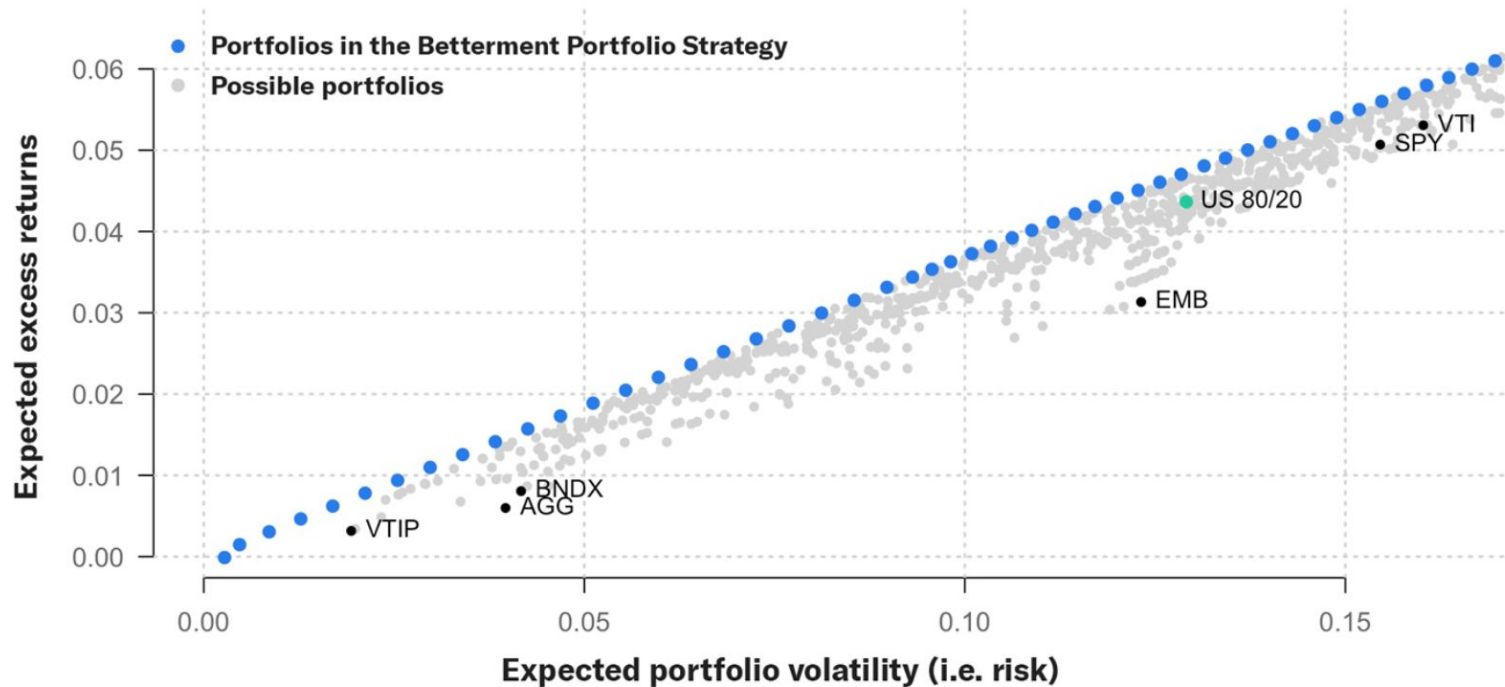
Combine with views



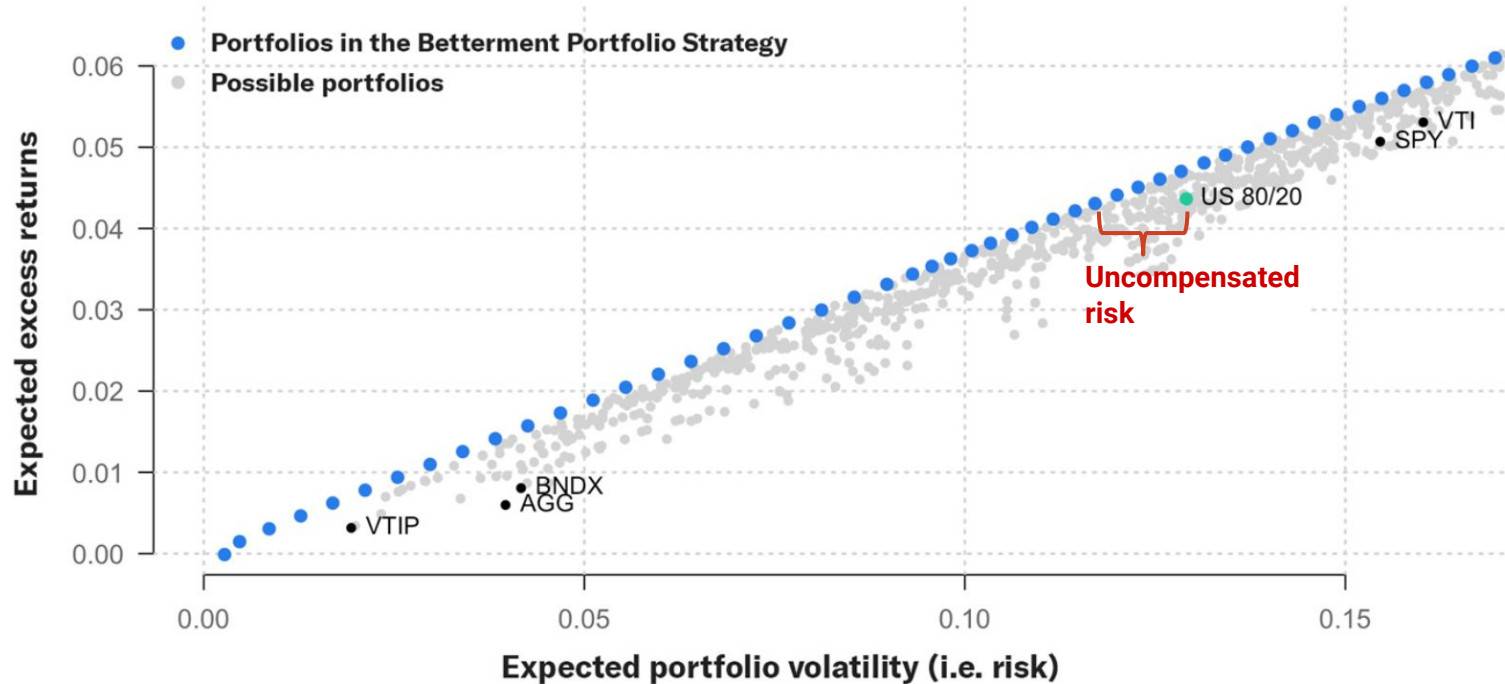
+ Small-cap stocks
+ Value stocks

(H/T: [Fama-French](#))

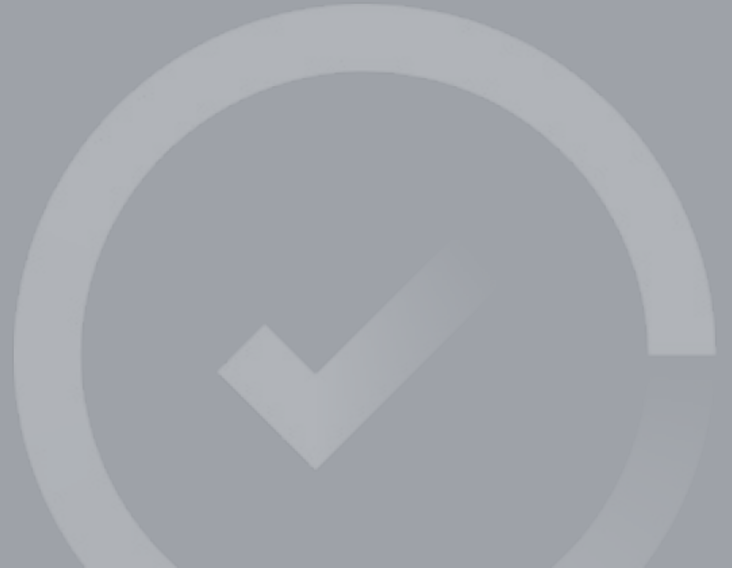
Resulting Betterment portfolio



Resulting Betterment portfolio



**Manage to optimal portfolio weights
with technology**



Manage to target weights automatically

Current Portfolio



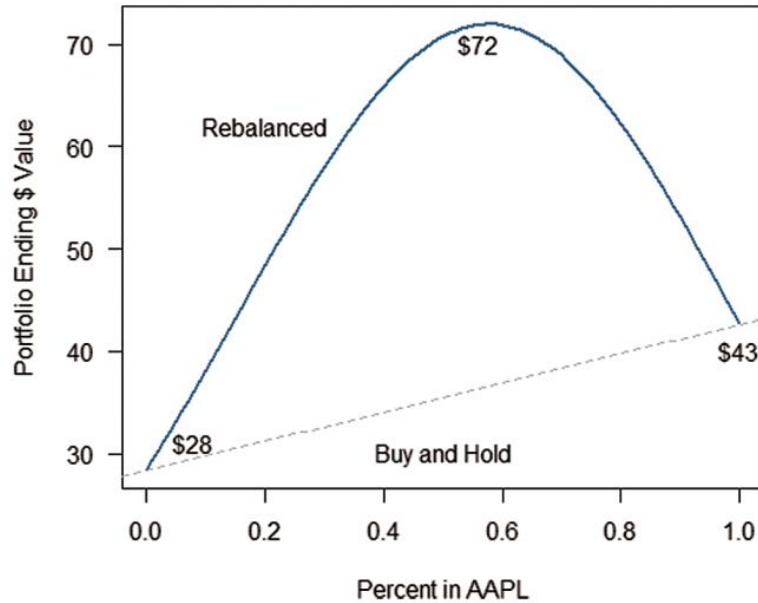
Target Allocation

70% stocks

- Use technology to monitor portfolio risk intra-day
- Use cash flows to rebalance when possible

Rebalancing as a source of alpha

Growth of \$1 for Apple and Starbucks Portfolios
(1994–2011)



Rebalancing less than 100% correlated assets results in outperformance compared to simple buy and hold of either asset

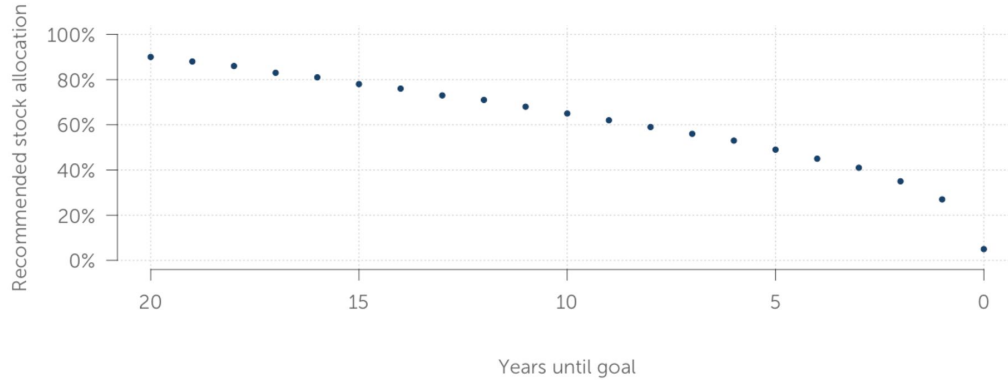
Rebalancing as a source of alpha

Growth of \$1:
$$g = \mu - \frac{\sigma^2}{2}$$

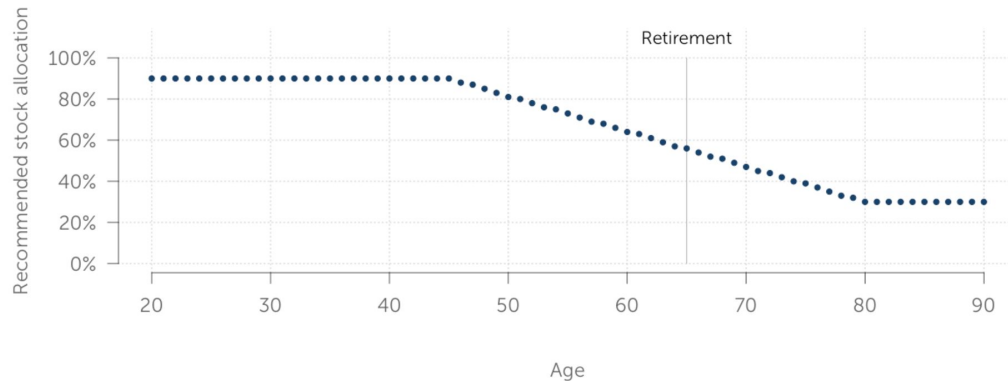
Growth of
portfolio:

$$\begin{aligned} g_p &= \sum_{i=1}^N w_i g_i + \frac{1}{2} \left(\sum_{i=1}^N w_i \sigma_i^2 - \sum_{i,j=1}^{N,M} w_i \sigma_{ij} w_j \right) \\ &= \text{Average Growth} + \frac{1}{2} \text{Average Variance} \\ &\quad - \frac{1}{2} \text{Portfolio Variance} \\ &= \text{Average Growth} + \text{Rebalancing Premium} \end{aligned}$$

Risk levels by goal type and horizon



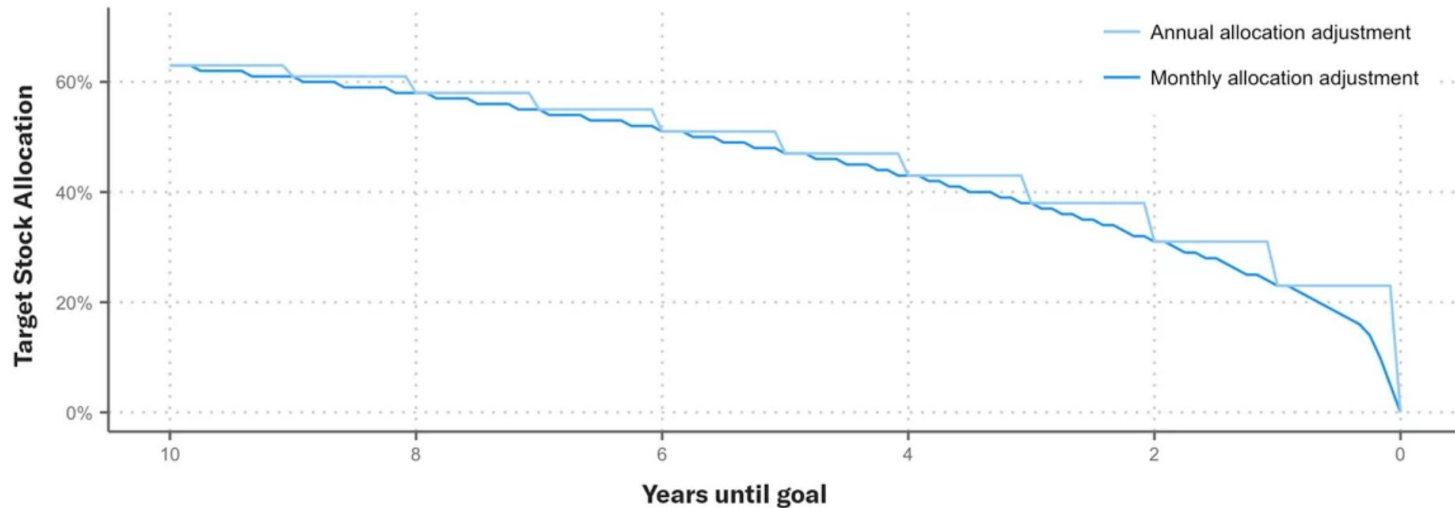
Major Purchase - Shorter time horizons; liquidate full account value at maturity



Retirement - Longer time horizons; periodic withdrawals

Adjust risk level automatically

Major Purchase Target Allocation through Time



Continuous risk management, better opportunity for rebalancing with cash flows

Minimize fees



Optimize returns net of fees, taxes, and behavior

Portfolio Returns

- fees

- taxes

- behavior

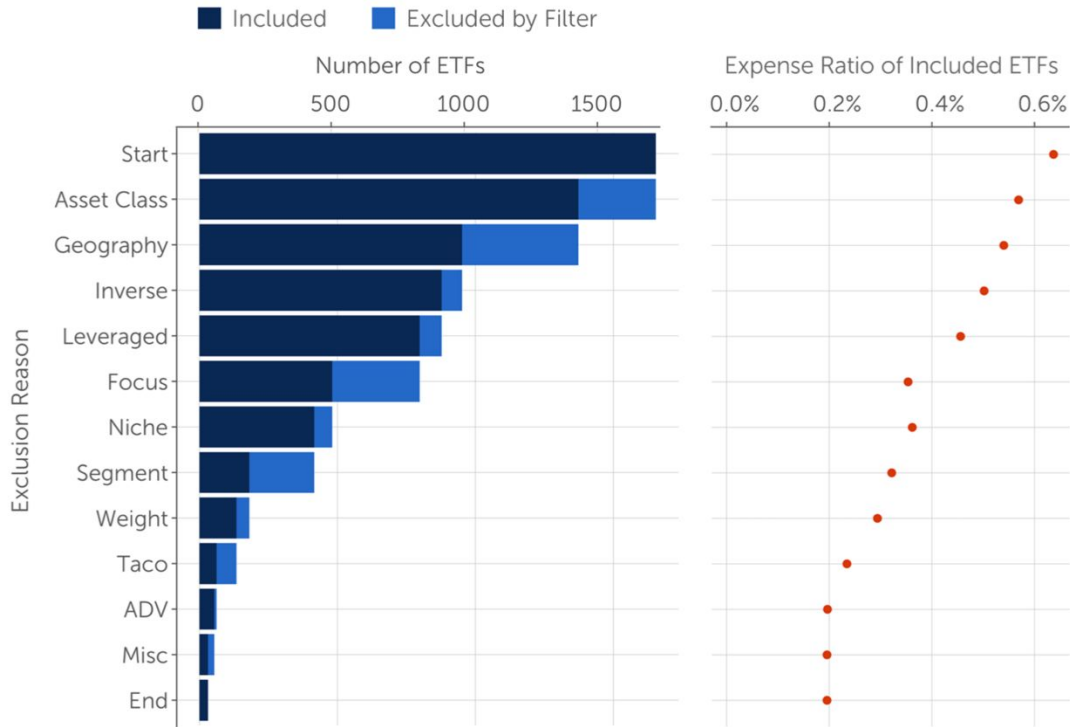
Investor Returns

Technology + experts for fund selection

- Use technology to **filter**, **rank** and **sort** securities in our investable universe
- Display the top candidates in more detail
- Expert review and investment committee approval before adding to portfolio



Start by filtering investable universe



ETF Exclusion By Category

- Start with the all investable ETFs
- Remove concentrated, niche and specialty funds
- Focus on broad-based index funds

Sort by Total Cost of Ownership (TACO)

TACO



Cost to Hold

Expense Ratio

Tracking Difference



Cost to Trade

Bid-Ask Spread

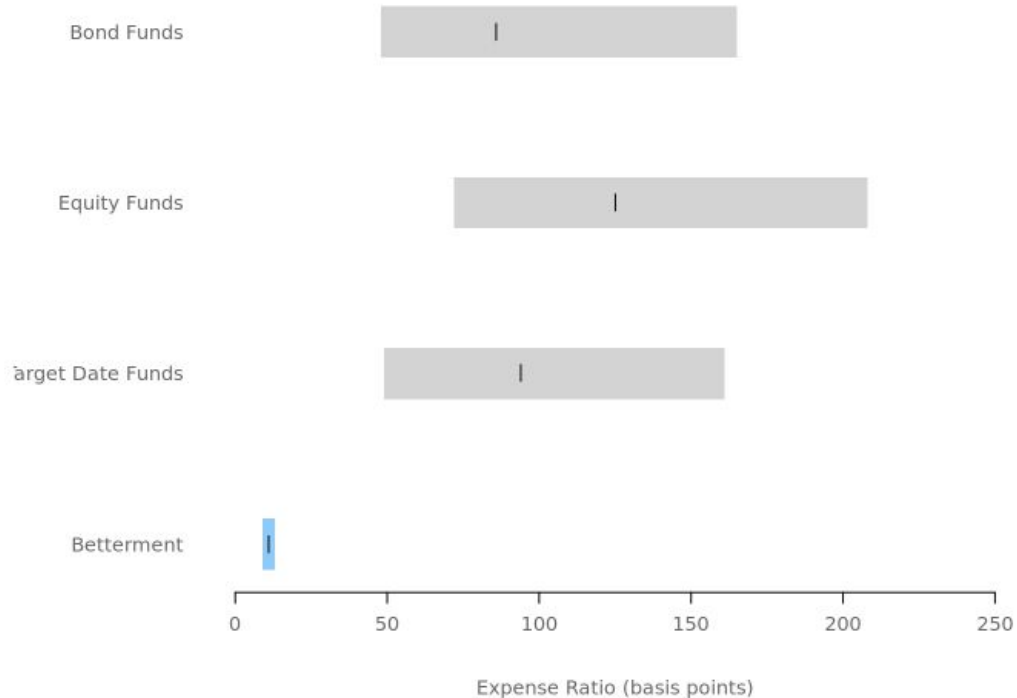
Liquidity (Volume)

Detailed view of top candidates

Component	Ticker	Name	ExpRatio (bps)	Spread (bps)	Cost to trade (bps)	Track. Diff (bps)	taco	taco_rank	ADV	Index	Potential ExpRatio (bps)
EQ_US_AC_AS_NA	VTI	Vanguard Total Stock Market ETF	4	0.8	0.9	-0.7	3.9	1	234.34	CRSP US Total Market Index	
EQ_US_AC_AS_NA	SCHB	Schwab US Broad Market ETF	3	2.7	14.3	-6.1	6.8	2	21.44	Dow Jones US Broad Stock Market Index	
EQ_US_AC_AS_NA	ITOT	iShares Core SP Total US Stock Market ETF	3	3.9	15.2	-8	7.1	3	29.52	SP Total Market Index	
EQ_US_AC_AS_NA	IWV	iShares Russell 3000 ETF	20	1.9	13.3	-18.1	23	4	16.79	Russell 3000 Index	

Process keeps costs low

Mean and Range of Fund Fees



- **Low-cost, broad index ETFs**
- **Portfolio expense ratios:**
7bps - 17bps
- **Technology keeps management fees low:**
25bps

Keep taxes low



Optimize returns net of fees, taxes, and behavior

Portfolio Returns

- fees

- taxes

- behavior

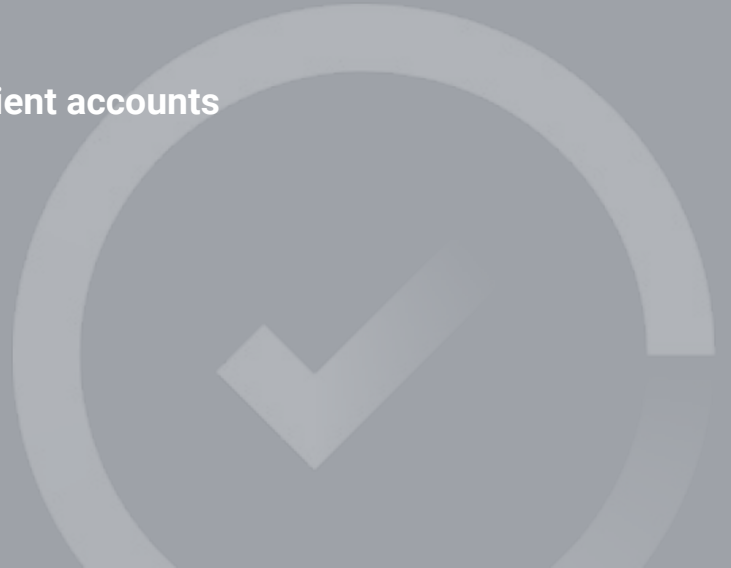
Investor Returns

Tax minimization strategies

- Asset location
- Tax loss harvesting
- Lot sorting
- Rebalancing
- Investment vehicle (ETFs)

Asset location

Putting tax-inefficient investments (bonds) in tax-efficient accounts (IRAs)



Asset Location

Not asset located:

- Self-contained diversified portfolio in each account – Roth, Traditional and taxable accounts

Asset located:

- Maintain overall level of diversification
- Locate tax-inefficient assets in tax-advantaged accounts

Asset Allocation By Account

Taxable



Traditional

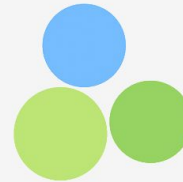


Roth



Asset Allocation By Account

Taxable



Traditional

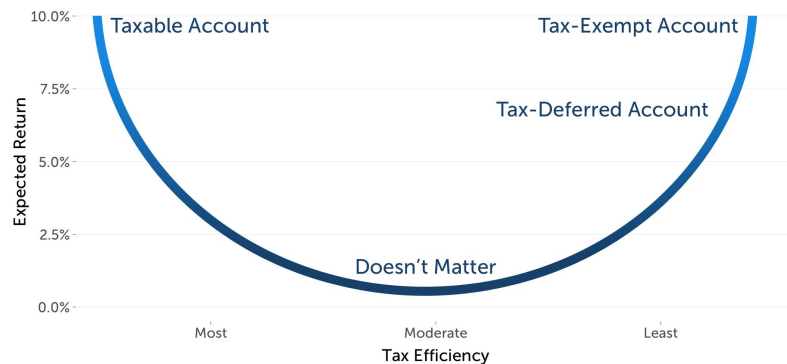


Roth



Asset location can be optimized

- **Optimized using linear programming**
- **Accounts are continuously monitored**
- **Goes beyond rules of thumb:**
 - Consider growth rate of assets
 - Dividend yield *and* growth rate matter
 - Consider tax drag *and* liquidation taxes
 - QDI ratios



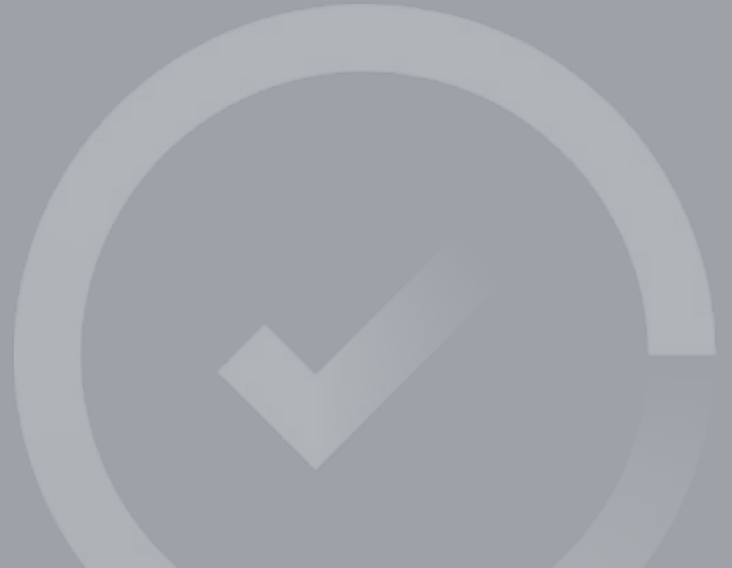
Source: The Kitces Report, March/April 2014.

Asset location implementation is tested for tax alpha using tax lot monte carlo simulations

As a result, investors can get higher take-home returns from TCP than they do traditionally

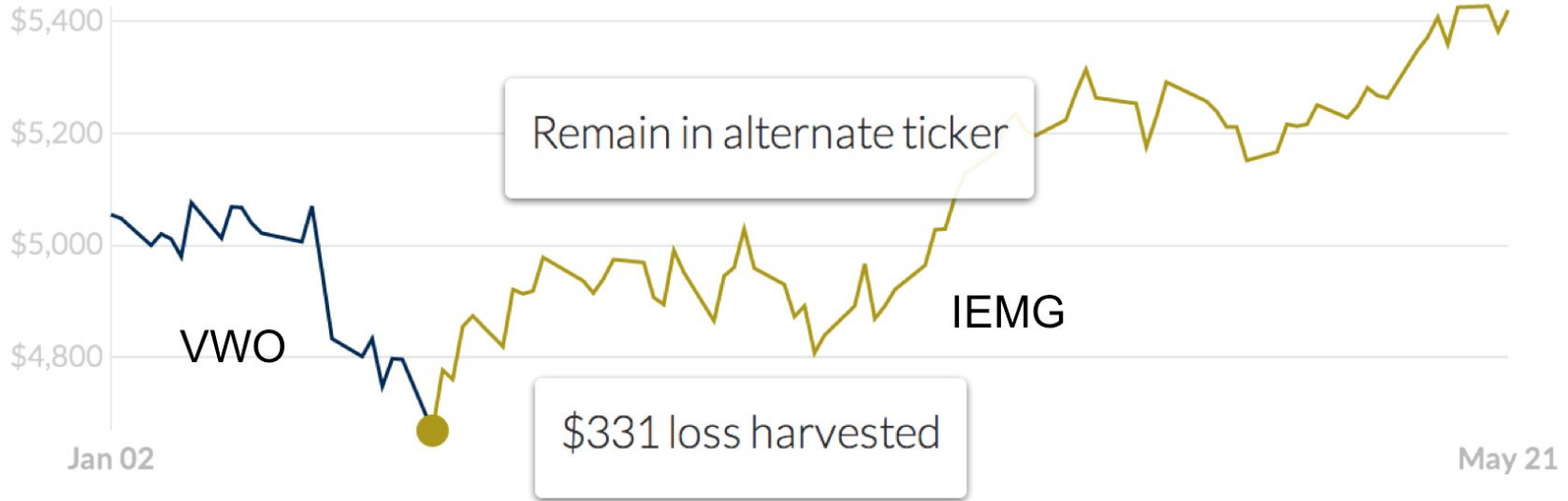
Asset Allocation	Additional Tax Alpha with TCP (Annualized)
50% Stocks	0.82%
70% Stocks	0.48%
90% Stocks	0.27%

Tax loss harvesting



Tax Loss Harvesting: An example

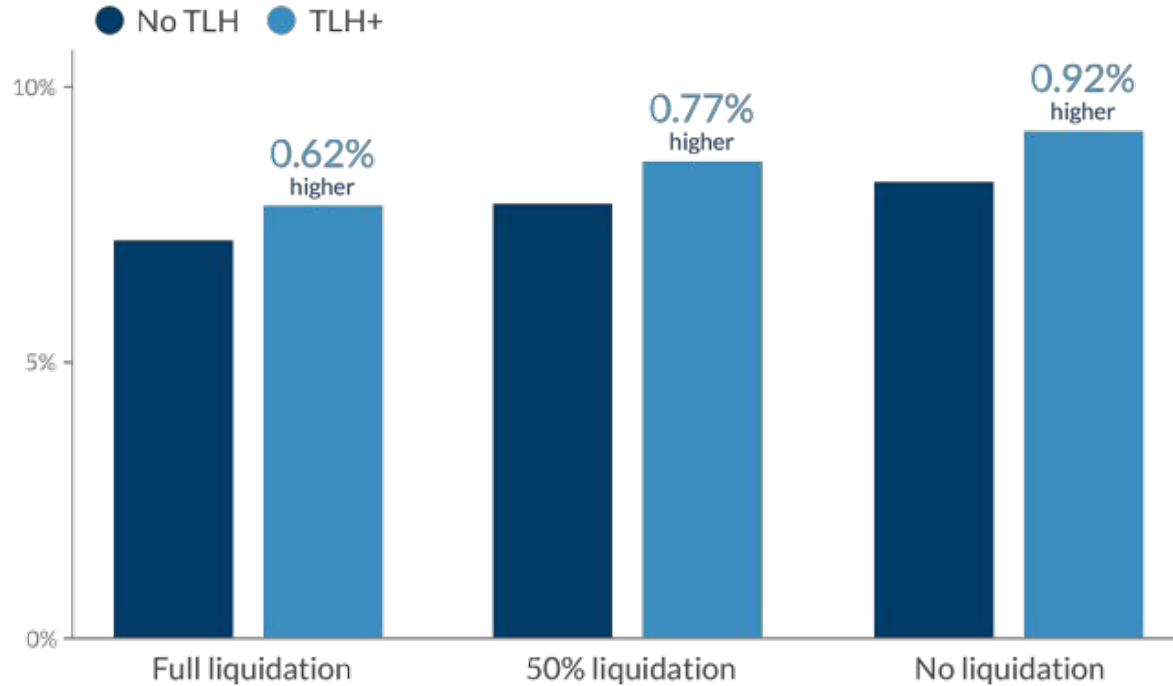
Emerging Markets, 1/2/2014 - 5/21/2014



TLH innovations

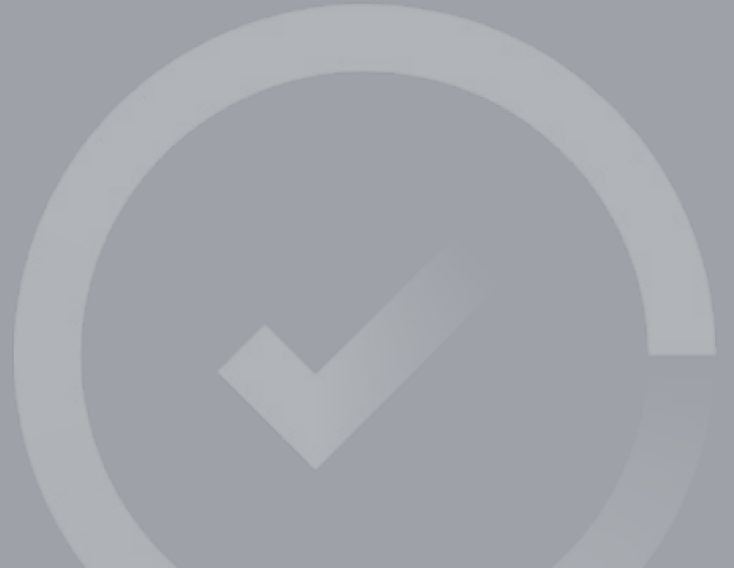
- Stay in secondary ticker after harvest (ie, don't switch back immediately)
- Rebalance with each harvest
- Considering spousals accounts to avoid wash sales
- Different secondary ticker for IRA accounts to avoid permanent wash sale rule
- Continuous, intraday monitoring

TLH is backtested to demonstrate after-tax alpha

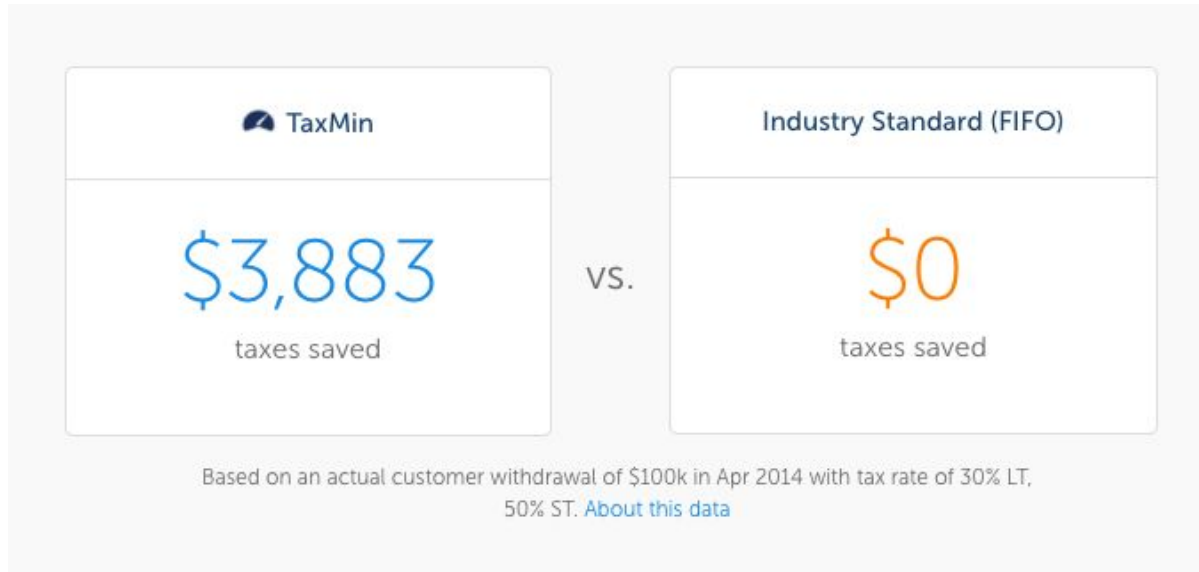


- Average rate tax payer
- Average savings schedule

Tax lot management



Intelligent lot sorting



- Automatically manage sales at the lot-level intelligently
- Sell lots with losses first, then least gains

Other tax features

Smart Rebalancing

- Rebalance with dividends and inflows/outflows
- Only rebalance by selling (and realizing a potential tax event) if we have to
- TLH as rebalancing opportunity

ETFs vs Mutual funds

- ETFs lower tax bills due to their legal structure
- Benefits from create-redeem structure to keep basis high.
- Mutual fund holders must pay the capital gains taxes from those who redeemed shares

Behavior matters

Don't just do something...
Do something useful



Optimize returns net of fees, taxes, and behavior

Portfolio Returns

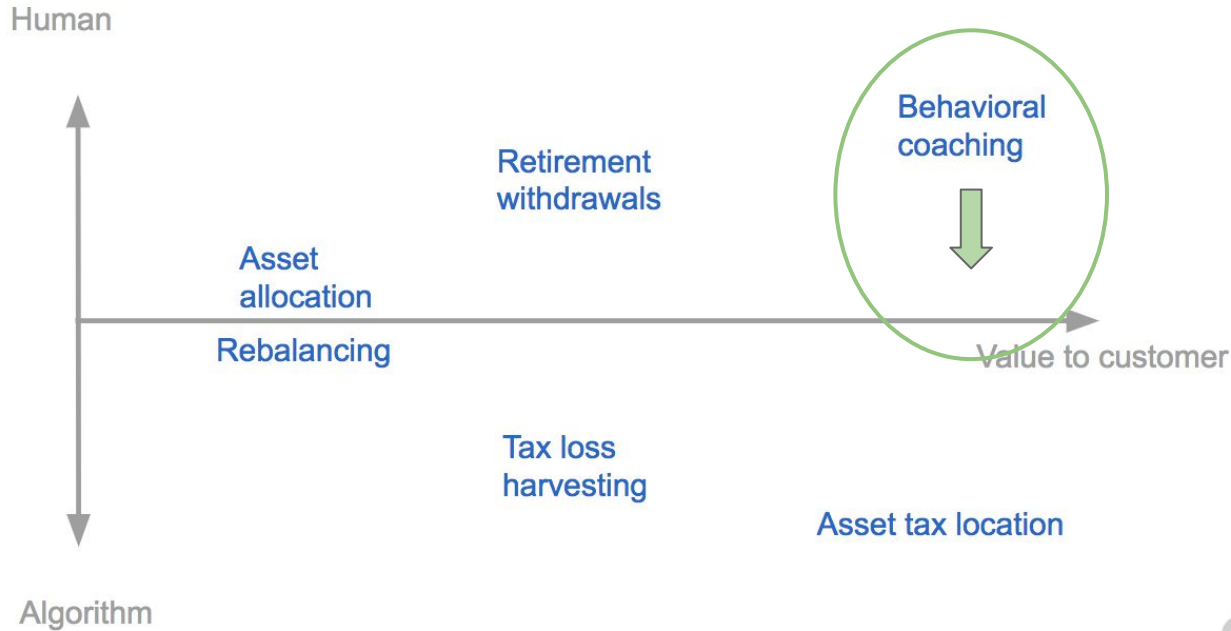
- fees

- taxes

- behavior

Investor Returns

Spending time efficiently

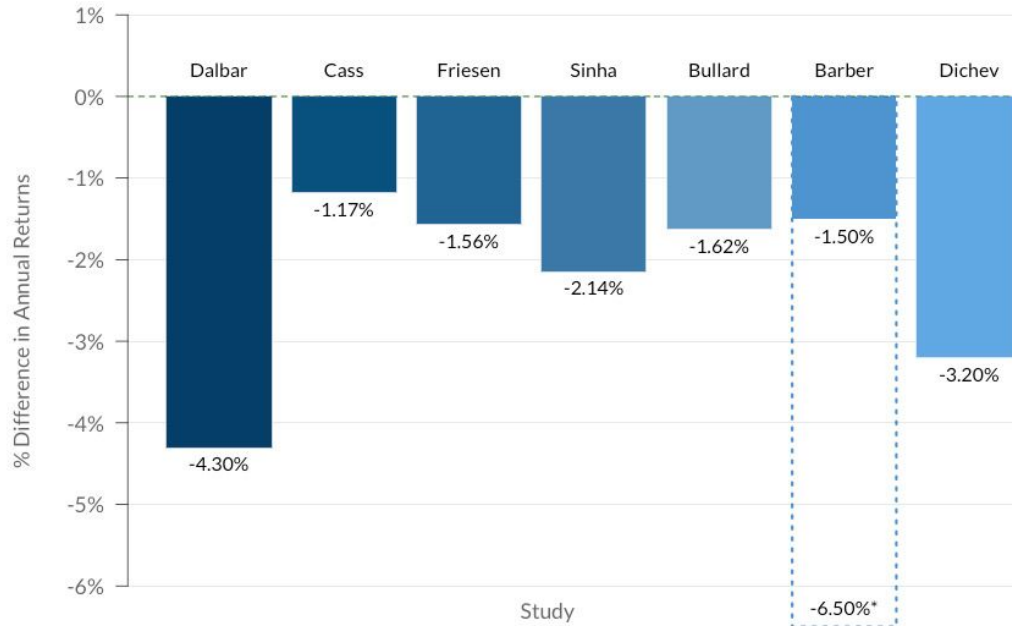


Fighting market timing



Bad behavior is costly

Estimates of the Behavior Gap

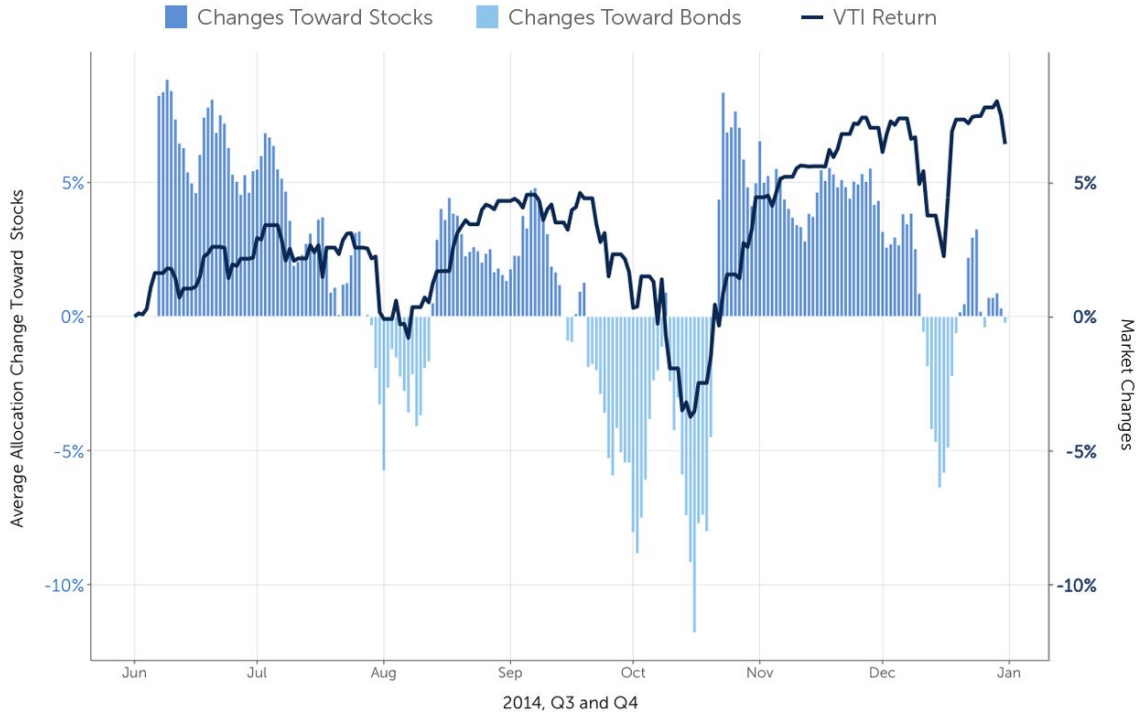


bit.ly/BehGap

See references for links to published results and methodologies.

*Given for the most actively trading investors in sample.

A minority of customers market time

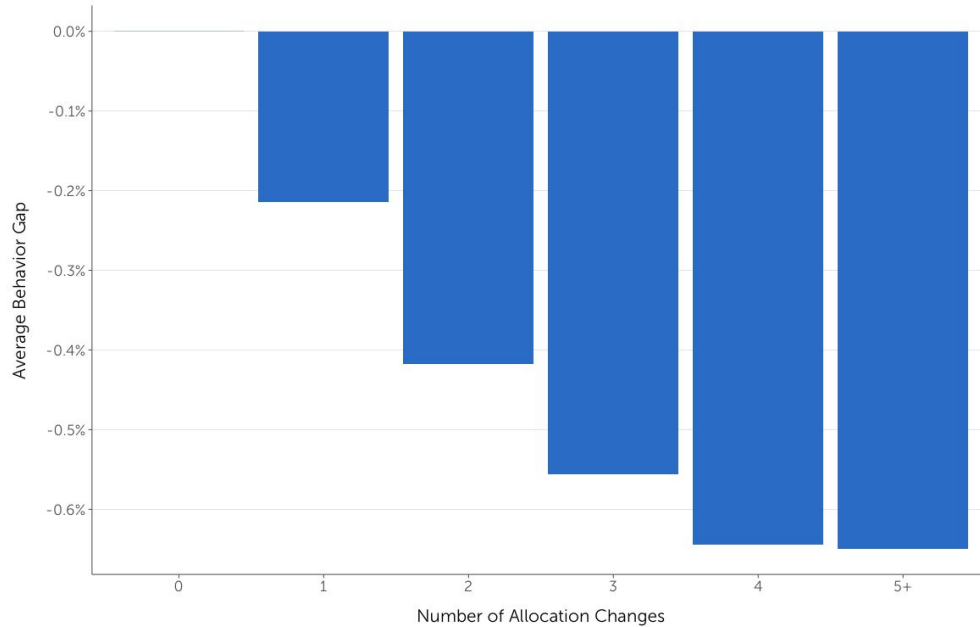


.. and tend to do it badly, by reacting to markets

- Average behavior gap of 22 bps
- 74% of accounts are better than this average

Sources: Market data from Xignite; Betterment customer data. Active users for each period are those who changed their allocation in the previous 7 days

The more you futz, the worse off you generally are

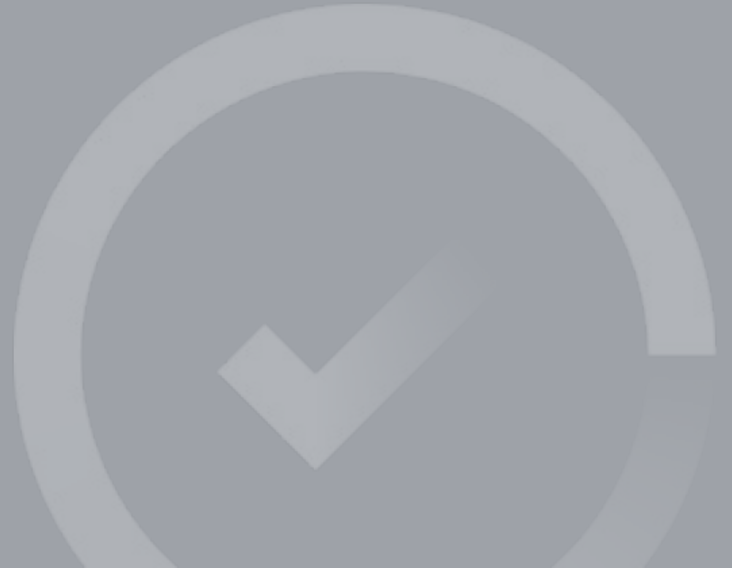


The number of allocation changes is clearly related to the size of your behavior gap.

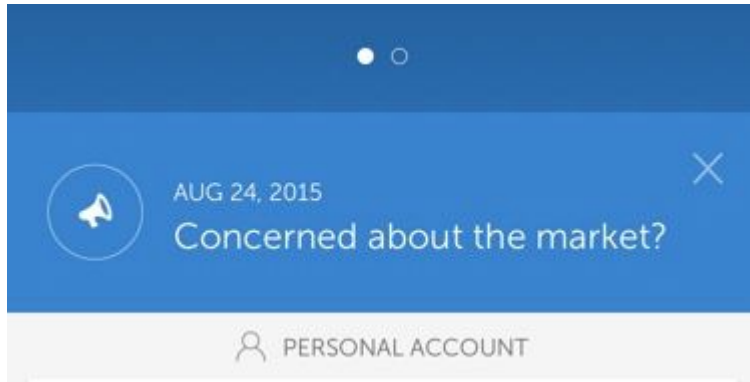
Sources: Betterment customer data.

Engaging during downturns

Platform and testing FTW



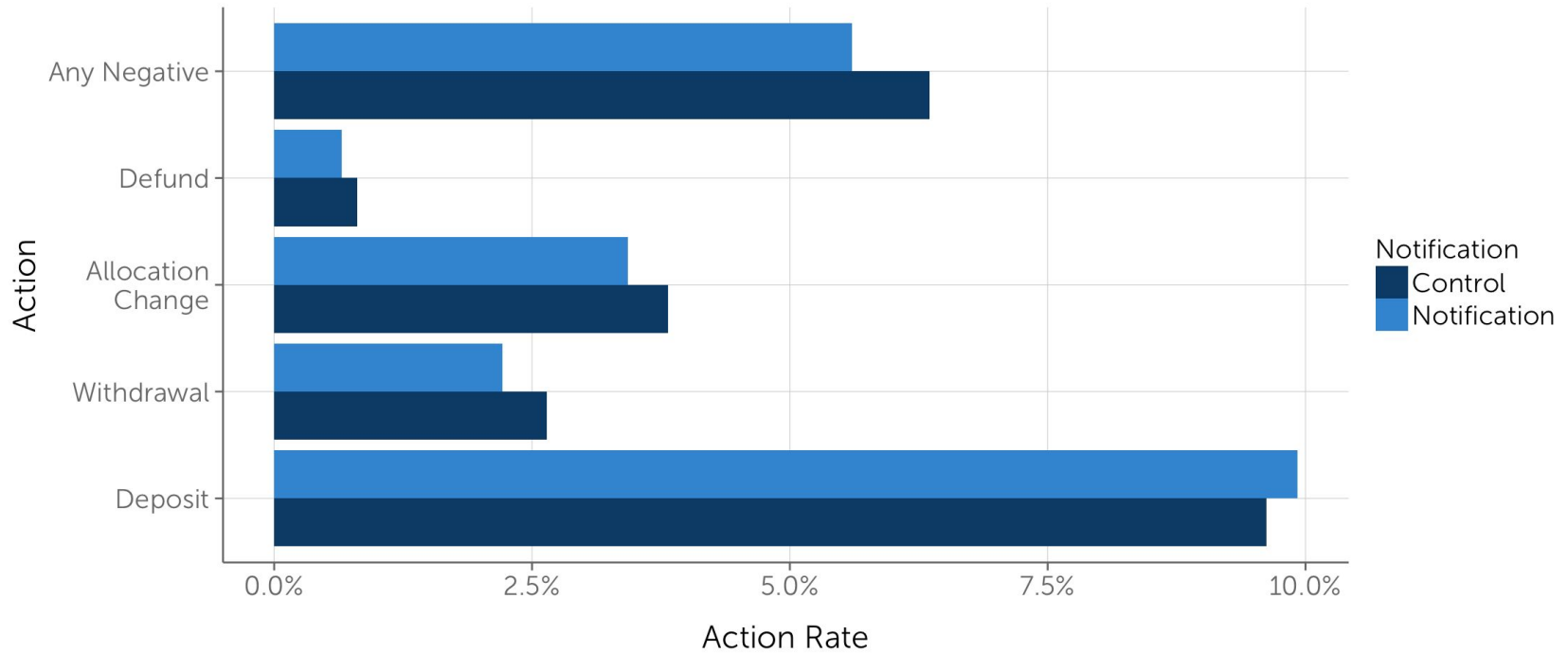
Behaviorally targeted notification



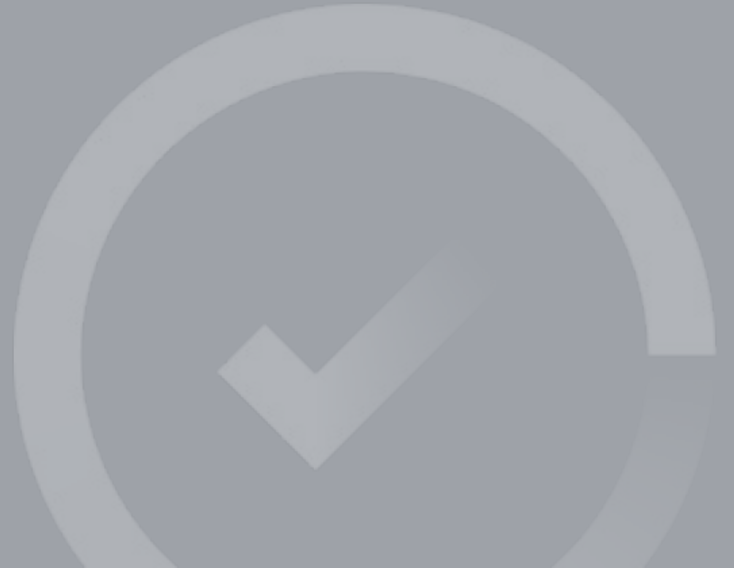
Not every customer is stressed by markets...

How do we target just those who need reassurance?

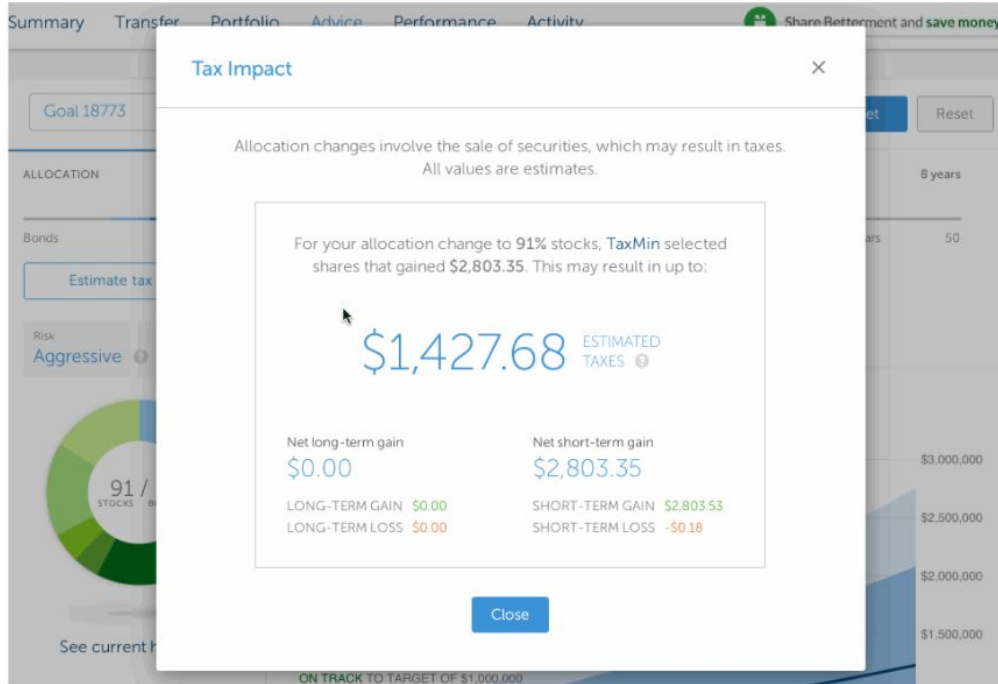
How effective is a simple in-app notification?



**Pitting biases against
each other**

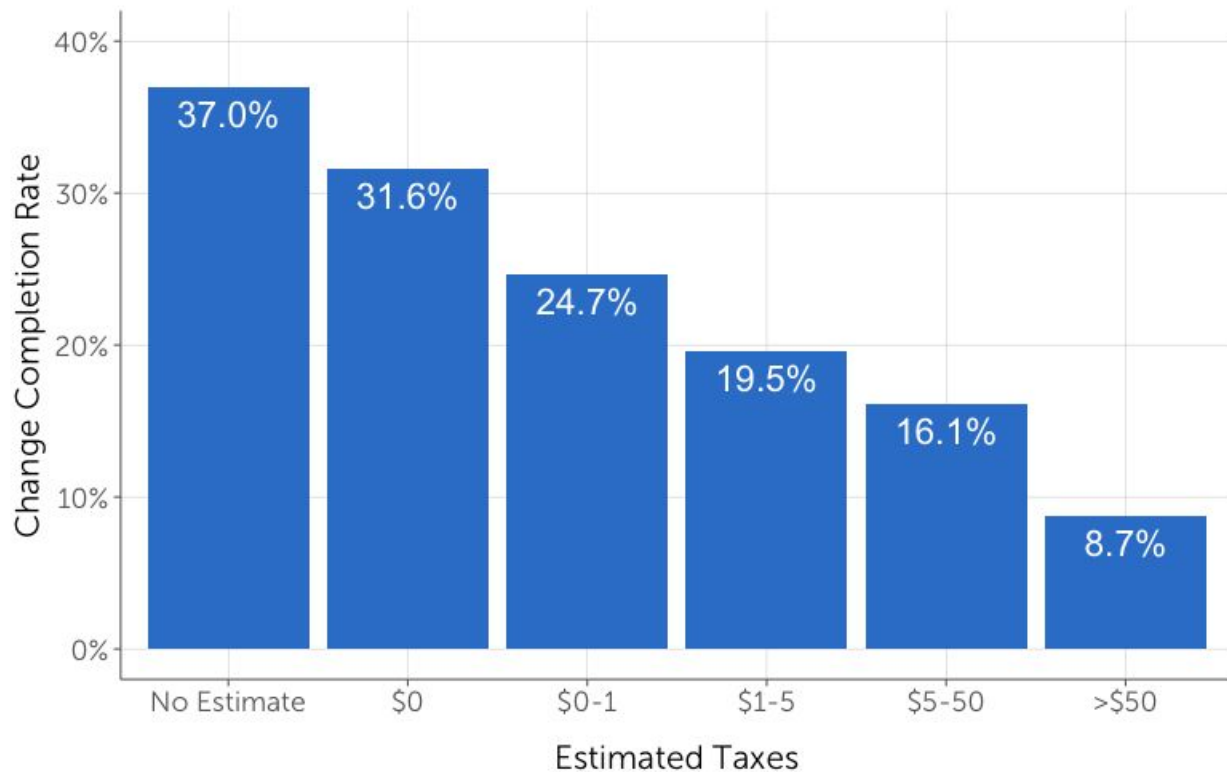


Pit biases against each other: Market timing vs taxes



- Before an action (allocation change, withdrawal), we show you the likely tax impact.
- You decide if it's still worth it, after-taxes.
- We give customers the power to do cost/benefit analysis in real time and this impacts their behavior

We saw a significant reduction in realized gains









Personalized advice



Advice is goal based

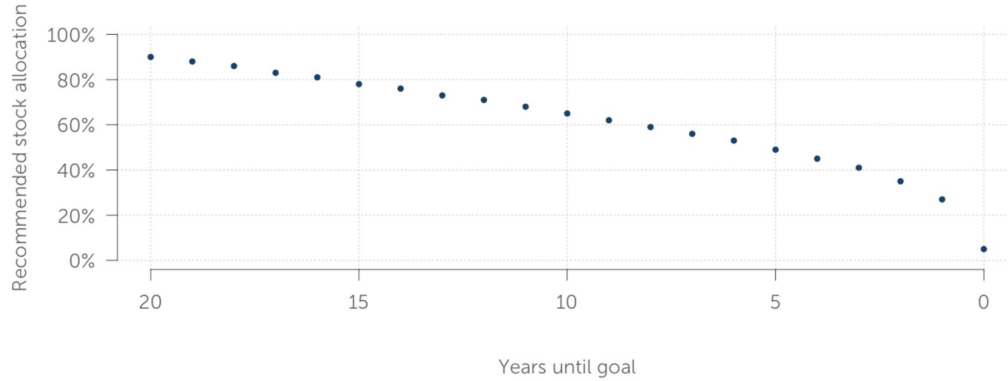
What are you looking to achieve through investing?

Here's a list of objectives that we think you might find compelling.

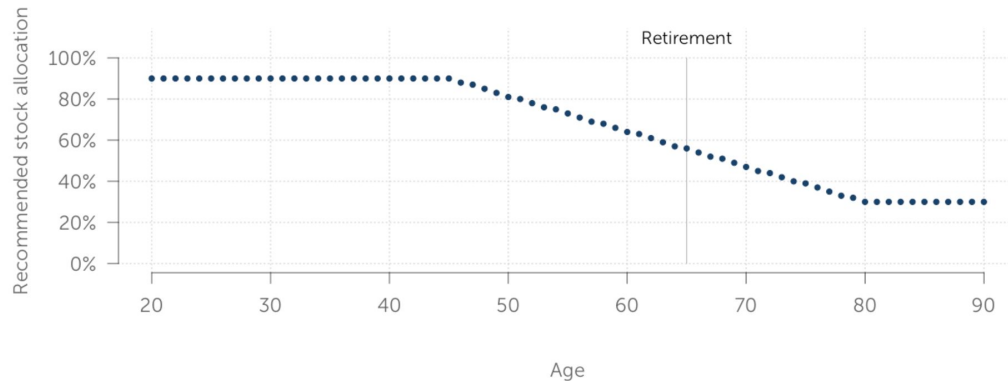
<input checked="" type="checkbox"/>  Being able to retire comfortably	<input checked="" type="checkbox"/>  Having money in case of emergencies	<input type="checkbox"/>  Earning more from my checking or savings
<input checked="" type="checkbox"/>  Putting my kids through college	<input type="checkbox"/>  Becoming a homeowner	<input type="checkbox"/>  I just want to grow my money

- Aligns portfolio risk with financial objective more accurately
- Mirrors how people actually think about money
 - Mental accounting

Risk levels by goal type and horizon



Major Purchase - Shorter time horizons; liquidate full account value at maturity



Retirement - Longer time horizons; periodic withdrawals

Feedback on portfolio risk level

Target Allocation

80% Stocks

Overall risk [?]

Too aggressive



Less risk

More risk

Auto-adjust: Off



Recommended: 60% Stocks

Keep in mind that by turning auto-adjust off, your portfolio risk level will not automatically decrease over time.

Submit

Projections

Holdings

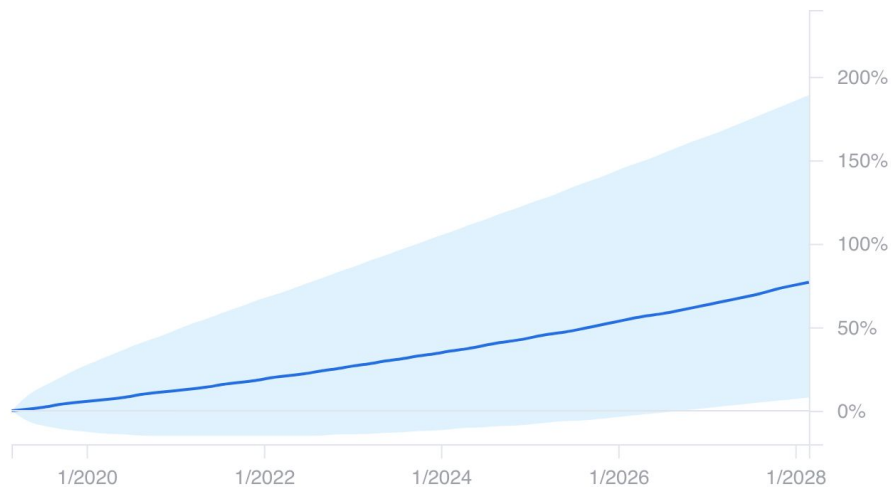
Allocation over Time

Likely 1 year return [?]

-13% to +31%

Avg. annual return

+6%



— Average outcome ■ Outcome range

We recommend the right amount to save

Recommended

Age 66

Recommended

\$591.72

Recommended

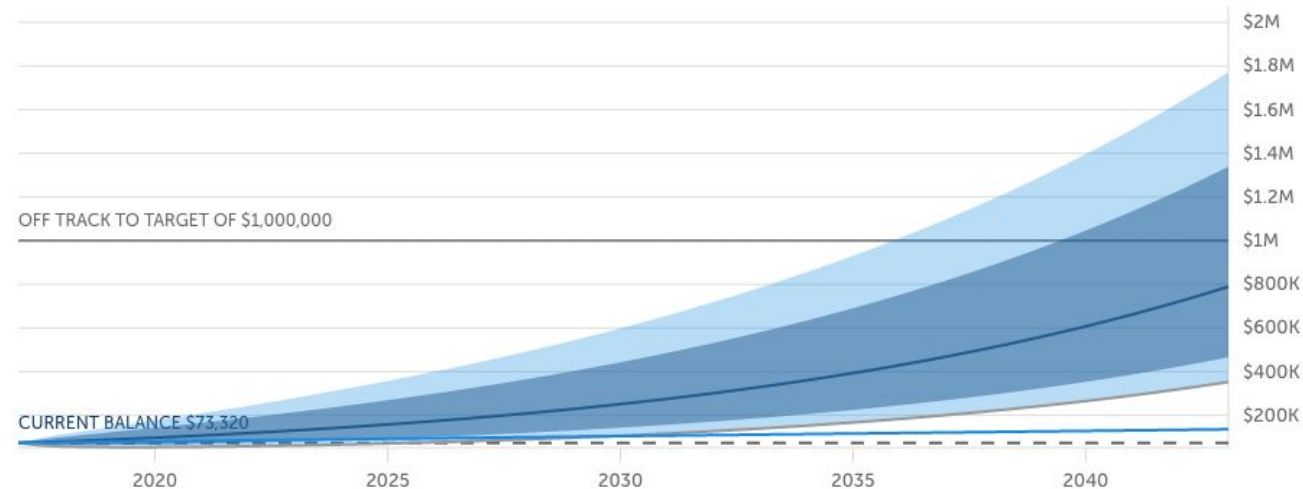
\$55,748.00

AVERAGE MARKET PERFORMANCE

\$788,826

POOR MARKET PERFORMANCE

\$352,200



- Project customer balances into the future
- Show distribution of likely outcomes
- Recommend the right savings amount to reach their goals

Advice on all accounts: External account advice

Total Fees Per Year [?]
High \$2,264.01

Idle Cash [?]
High \$64,875

Current Portfolio [?]



Holdings	Shares	Fund Fees per Year % \$
Mutual Fund		
FCNTX: Fidelity Contra Fund ● US Stock and 1 more	79.31	0.68% [!]
FDCAX: Fidelity Capital Trust Capital Appreciation Pt. ● US Stock and 2 more	166.98	0.61% [!]
FDVLX: Fidelity Value Fund ● US Stock and 2 more	150.86	0.67% [!]
FLPSX: Fidelity Low-Priced Stock Fund ● US Stock and 2 more	61.53	0.88% [!]

Thanks!

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Betterment

[Important disclosures](#)