NORTHFIELD modeling financial markets worldwide

Portfolio Customization

My Name is LUUCA[1]

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1. With apologies to Suzanne Vega, “Luka” was popular rock song released in 1987

Introduction

- There have now been three well publicized acquisitions by major investment firms relating to portfolio customization capabilities.
  - Morgan Stanley (Eaton Vance, Parametric, Calvert)
  - Blackrock (Aperio)
  - JPMorganChase (55IP)

- It would appear that the industry is finally reaching the "tipping point" where portfolio customization on a mass scale will be the industry norm rather than a high-cost option limited to "High Net Worth" investors.
  - We are about 90 years behind automobile manufacturing.

- Northfield has pioneered the analytical techniques and production systems needed for mass-customization for twenty-five years.
  - Our systems already support customization of hundreds of thousands of portfolios, with analytical methods that are *already far more sophisticated* than what is being implemented elsewhere in the industry.

A Stopped Clock is Right Twice A Day

- In 1999, Northfield provided the analytical engine for the first "robo-advisor" for O'Shaughnessy Asset Management

- In 2006, Investment of Private, Taxable Wealth was published by the CFA Research Foundation (diBartolomeo, Horvitz and Wilcox)
  - This book describes "best practices" for managing taxable assets
  - While every method therein can be automated, few asset management firms have even scratched the surface of these processes

- The production systems to fully automate sophisticated portfolio customization have existed for two decades.
  - Also in 2006 we created a series of six short videos to illustrate the concept and methods of "portfolio manufacturing"
  - https://www.northinfo.com/docs/MARS_Overview.mp4

LUUCA

- To facilitate the implementation of portfolio manufacturing, we've created an analytical "workflow" model we call LUUCA

- The key elements of LUUCA are a series of portfolios
  - Legacy
  - Unconstrained
  - Ultimate
  - Constrained
  - Actual

- Every step of the LUUCA method can be automated

Legacy

- There are two common starting points for every investment process involving customization. The first is the legacy portfolio:

- Legacy Portfolio
  - The investor's current portfolio.
  - It may be a portfolio that the manager inherited when the investor engaged the manager.
  - For HNW investors, this portfolio may involve large concentrated positions.

Unconstrained and Ultimate

- The inputs to the *hypothetical* Unconstrained Portfolio include
  - The asset manager's best investment ideas delivered as one or more (e.g. separate for E, S, and G) portfolios or funds
  - Alternatively, a fully quantitative process can be used (e.g. security level alphas, risk model, etc.)
- This hypothetical portfolio operates without consideration of constraints and costs
  - It can be long/short, use leverage (hold cash)
  - No other hard constraints
  - Ignores transaction costs and taxes
- The hypothetical Ultimate Portfolio adds in the influence of the *relevant subset* of the investor's financial goals and preferences.
  - This is the ideal portfolio the investor *would like to have*

Constrained

- Real world investing involves expressing lots of financial concepts and some non-financial ones in the form of hard constraints
  - Portfolios are often "long only"
  - Investors may have multiple accounts with different legal structures (e.g. regular taxable, and tax advantaged retirement accounts) between which capital cannot flow
  - Investment managers may have typical investment constraints on portfolio construction or portfolio evolution (e.g. turnover)
  - Primitive form of "customization" is allowing simple investor constraints:
    - "Don't invest in" (tobacco, carbon fuels)
    - "Never invest in Amazon because my grandmother was run over by an Amazon delivery truck"
    - "Never sell the IBM shares I inherited from my grandmother"
- The Constrained Portfolio is optimized to be feasible within the constraints starting from the Legacy portfolio to be minimum variance to the Ultimate portfolio.

Actual

- The Actual portfolio is the "live" portfolio that the investor holds at each moment in time.
  - You can also think of the Legacy portfolio as the previous version of the Actual portfolio
- This portfolio incorporates all *costs* in the investment process
  - Structural tax effects (e.g. there is no US tax on the income from municipal bonds)
    - Tax-advantaged retirement accounts
  - Tax effects of transactions (tax lots or "parcels")
  - Other taxes
  - Realized transaction costs
  - Opportunity costs for active managers
    - Lost alpha due to trades not done due to *expected* costs

The Tortoise and The Hare (Sneddon 2008)

- Due to the high influence of taxes and investor constraints, you can think of the times series relationship between the Ultimate portfolios and the Actual portfolios like the fable of the Tortoise and the Hare.
  - The Ultimate portfolio series is what the investor would want, but the Actual portfolio composition always lags
  - By studying the relative performance of the five portfolios over time we can understand the sources that influence the realized performance of a customized portfolio
  - We will later propose a proprietary definition of *after-tax returns*
- This conception of the dynamics of portfolio evolution over time is well explored in Sneddon (*Journal of Investing*, 2008)
  - Basis of the Complete Attribution (CAtt) analysis available from Northfield

Customization for Taxes

- Being "Tax Aware" is the most complex and popular form of customization
- Structural tax effects are long term, strategic issues of asset allocation and asset "location"
  - Investor tax domicile (city, state, country)
  - Tax effects by investment type (e.g. muni bonds)
  - Conceptual basis is the effective tax rate (see CFA book)
  - Adjustment for embedded gains/losses in Markowitz and Blay (JOIM, 2016)
- Lot by Lot tax awareness of long/short term capital gains
  - Most countries have "wash sale" rules
  - Complex tradeoffs particularly with alpha decay in active management

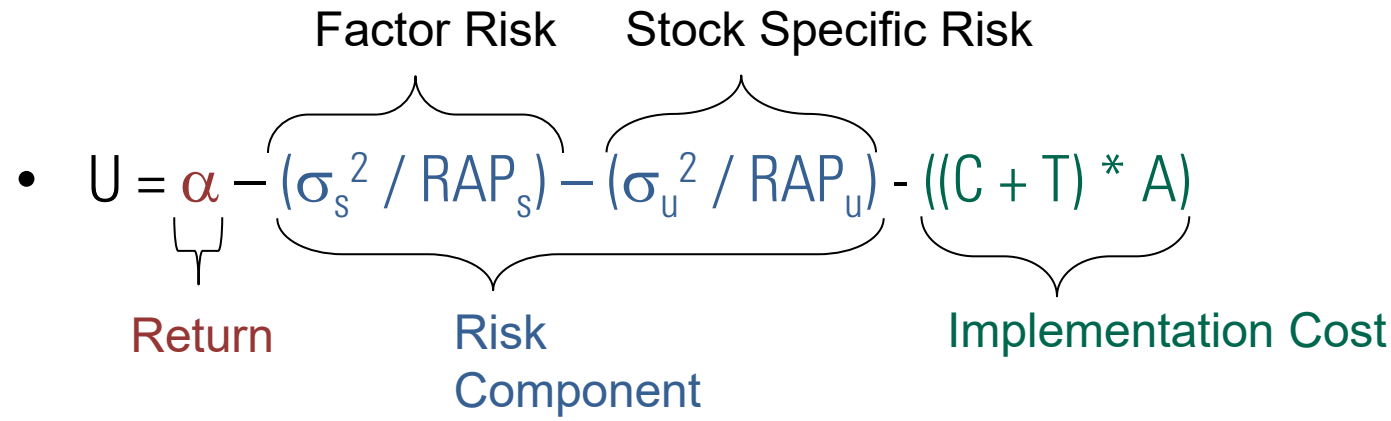
The Laundry List of Tax Effects on US Investors

- Possibly Applicable Tax Rules, see Simpson (2020)
  - Short Term Capital Gain / Loss
  - Long Term Capital Gain / Loss
  - Special five-year Capital Gain/ Loss
  - Interest and discount/premium amortization US Government Bonds
  - Interest and discount/premium amortization Municipal bonds for resident
  - Interest and discount/premium amortization Municipal bonds non-resident
  - Qualified dividends (equities of US companies held more than 44 days)
  - Non-qualified dividends
  - Other interest, dividends and amortization
  - For some entities, unrealized gains/losses
  - Section 1256 rules for derivatives (futures, options)
  - Section 998 rule for currency gain/loss
  - Wash sales
  - Dozens of bi-lateral treaties on foreign withholding tax on dividends to US investors

Most "Tax Aware" Portfolios Aren't Even Legally Sound

- For a portfolio to be managed effectively in a tax efficient manner, the process must account for both structural and "lot by lot" tax effects.
- Most systems that purport to provide tax efficiency just put simplistic rules in place that purport to carry out "tax loss harvesting".
  - If a stock is down 30% from the purchase cost, sell it, replace it with an ETF for benchmark for 30 days, sell the ETF and buy the stock back.
  - The landmark legal doctrine that separates legal "tax avoidance" from illegal "tax evasion" arose from Gregory versus Helvering (US Supreme Court, 1935)
  - An investor can organize *investment motivated trades to minimize taxes* but cannot do trades solely for the purpose of reducing taxes.
  - Can you find an investment motivation in the "tax loss harvesting" rule above?
- Some systems offer greater sophistication but still not enough to allow for rational engagement with active management, offering insufficient analysis tax effects and the economic tradeoffs between return, risk, transaction costs, and taxes.
  - Of course, our systems do offer that and more (e.g. negative taxes on dividends in Australia called "franking credits").

Objective Function for Tax Aware Portfolios



- 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

Customization for Investor Goals: Investment Planning

- Proper formation of investment portfolios requires appropriate trade-offs between return and risk. As there is no universal agreement as to the semantics of risk aversion ("conservative", moderate, aggressive), most automated systems do not properly discover investor preferences and more importantly do not discover sufficient information about the household's *ability* to bear risk, as opposed to the *willingness* to bear risk.
- The *Discretionary Wealth Hypothesis* of Wilcox (Journal of Portfolio Management, 2003) has quickly become the industry standard. In essence, the household's ability to bear risk is formulated from a "life balance sheet" where all financial assets and liabilities are included.
- The balance sheet can be projected into the future so that future asset allocations can be achieved through how cash flows are reinvested rather than through rebalancing transactions (generally high tax events)
  - See papers by Balvers and Mitchell (1997, 2000)

Customization for "Human Capital"

- For many households that are not affluent, the bulk of the financial resources that they will use for major consumption expenditure (e.g. college tuition) and to provide retirement income do not yet exist. These resources will be accumulated in the future through the investment of savings taken from earned income, and from the long term compounding of the returns.

- While almost every automated investment system provides some provision for estimating the need for future savings by a household (often crudely), most do not consider the subtleties of how aspects of the future savings process should impact investment policy today and through time. A household may not realize any savings if the earning members die, are disabled or lose their employment.

More on Human Capital

- While the first two problems can be mitigated with insurance products, the third is more nuanced. Consider an individual who earns their living as a school teacher in the USA has a much higher degree of job security than would another individual who works as a financial analyst on Wall Street. In addition, the probability of losing a job as a financial analyst will be much higher in periods of poor financial market outcomes, while the job security of the typical teacher would be much less dependent on financial markets. Put simply, our teacher has a "low beta" job so the beta of present value of their future stream of savings is low.

- Our financial analyst has a very "high beta" job. After retirement their situations would be more similar. These differences and their likely progression over time should be incorporated into the investment policy and asset allocation processes. For background see Ibbotson, Chen, Milevsky and Zhu (CFA Publications, 2007).

Customization for Retirement Income Needs

- Most automated investment systems purport to address capital accumulation for retirement by giving the household a fixed dollar value target (e.g. 8 times desired annual income) to accumulate by the expected retirement date. This is a deeply flawed process.

- To the extent that a retail household has taken on their own mortality risk, the post retirement portfolio must provide a *steady stream of spendable income* over an indefinite future period (we don't know how long we will live).

- Consider the situation of investor who meets their hypothetical goal for portfolio value of eight times the desired annual income by the day before their retirement by holding a portfolio of zero yield growth stocks. I
  - If interest rates happen to drop suddenly the following day, it is likely that the household could not form a viable income portfolio.

Customizing for Mortality Risk

- Given the uncertainty of life span, most investors are very uncomfortable with deciding how much of their portfolio they can liquidate without creating the potential for running out of funds before death. Moving to a more income oriented portfolio is a standard practice of most "target date" funds but those blindly rely on the year of retirement to formulate the "glide path" while ignoring the household levels of wealth, liabilities and a host of other factors.

- Analytical solutions exist for properly defining the "duration" of the retirement consumption liability (like a short position in a bond), which will result in an appropriate glide path more customized to the needs of the individual investor. In essence, the presence of mortality uncertainty requires that we reframe investment risk in terms of the ability to produce lifetime income rather than as volatility in wealth units or return outcomes. Merton (*Harvard Business Review*, 2014) provides an excellent summary of the issues.

Customizing for Non-Mortality Life Uncertainty

- In considering the long term financial circumstances of a household, there are many other areas of uncertainty beyond mortality risk.
  - In saving for college tuition for our children, we really don't know if our kids will end up at Harvard or the local community college, so the magnitude of the tuition consumption expenditure is uncertain.
  - Most automated financial platforms assume that all financial goals are known with absolutely certainty both with respect to magnitudes and timing. In general, the greater the uncertainty of the input parameters of financial decisions, the more conservative the investment policies should be. A primary example of a great uncertainty would be the situation of divorce, which impacts more than half of all marriages.
  - The investment policy implications of life uncertainty are well addressed in Wilcox and Fabozzi (*Journal of Portfolio Management*, 2009) and more specifically about divorce in Scherer (Proceedings of London Quant Group, September 2014).

Integrating Asset Allocation and Asset Location

- Many automated investment systems try to address the accumulation of wealth to meet multiple consumption goals as multiple *separate* problems. For example, our college savings fund investment policies are unrelated to how our retirement fund, or other investments are structured. This leads to myopic and often very inefficient combinations

- A more relevant distinction is that the financial resources of the household is likely to be split between tax deferred legal structures such as defined contribution retirement plans (e.g. 401K, 403B, IRA or foreign equivalents) and financial accounts that are immediately subject to local and national taxes.

- See diBartolomeo, Horvitz and Wilcox (2006) Appendix A for computational details

Customization: Householding

- Another variation on the asset location problem is that of "householding." Many households have human or legal members (husband, wife, children, dependent elderly, trust funds) that may have heterogeneous aspects as investors including different tax circumstances, legacy portfolios and levels of risk aversion.
  - While one might choose to treat each of these entities separately, many households express a desire to have the investment policies and holdings for all members of the household be harmonized across tax circumstances and risk aversion so that the aggregate investment portfolio is optimal for the entire household, as compared to each person's portfolio consisting of what is best for them alone.
  - At a minimum two portfolios owned by two spouses filing a joint tax return in the USA must be treated as one taxpayer for the purpose of "wash sale" rules.
  - For full discussion see https://www.northinfo.com/documents/874.pdf.

Tax Lot Management Across Asset Classes

- Tax management requires dispersion of asset returns.
- The dispersion of returns can arise in three ways. We can purchase the same asset repeatedly at different times to create dispersion in level of realized capital gain and loss across tax lots. This process takes a considerable period of time to become operational.
- See Horvitz and Wilcox (Journal of Wealth Management, 2003). Another way to create dispersion is to simply hold lots of individual securities as opposed to traded baskets such as ETFs or mutual funds.
- The cross-sectional variation of the individual securities will be far greater than the volatility of the related index basket. A good illustration of this is in diBartolomeo (2008, http://www.northinfo.com/documents/275.pdf).
- Finally, we can invest across asset classes either as baskets or (even better from a tax perspective) as individual securities.
- An excellent paper on tax management of US municipal bonds is Kalotay and Howard (Journal of Portfolio Management, 2014).

Customization: Concentrated Legacy Positions:

- Most "robo-investing" systems assume that the investor's entire portfolio is on their system and that the portfolio always starts from cash. Transition of any legacy portfolio positions must be able to be accomplished in a tax-sensitive fashion which rationally balances the desire to move to the new optimal portfolio with the costs and tax implications of doing so over a particular time horizon.

- Given the large tax effects which may arise from liquidation of concentrated legacy positions, this process must be based on an economic objective function that balances considerations of return, risk, trading costs and taxes over multiple periods.

- A "complementarity portfolio" approach to concentrated positions is covered in diBartolomeo, Horvitz and Wilcox (CFA 2006) is now well recognized and can also be implemented with leverage and hedging to accelerate the transition.

Customizing for ESG (Non-Parametric Preferences)

- Investor preferences could take on a myriad of issues from the desire for a socially-responsible investment portfolio to the avoidance of investments expected to do very poorly under the extreme conditions of a global depression.
  - Put simply, the investment policies and implementation should reflect all investor preferences and attributes
- Converting *qualitative preferences into quantitative scores* that can be used to "tilt" investment strategies is easily accomplished via the AHP method.
  - We've used AHP for more than twenty years
  - Bolster and Warrick (Journal of Wealth Management, 2008) is the seminal discussion for investment allocations.
  - Here is a fully worked example for selection of a car model: https://en.wikipedia.org/wiki/Analytic_hierarchy_process_%E2%80%93_car_example.
  -

Customized Performance Measurement

- There are three proposed methods of computing "after-tax" return
  - None are economically appropriate for separate accounts
- Pre-liquidation (CFA)
  - Ascribes no economic value to unrealized capital gains/losses
  - Inflates "after tax" return because the tax aware managers will avoid realizing gains on which taxes will probably have to be paid eventually.
- SEC for US Mutual Funds
  - Addresses the asymmetric treatment of capital gains for mutual funds under the US tax system.
  - Net realized capital gains must be distributed to fund shareholders, but net realized capital losses are not deductible currently (can be carried forward)
- Post Liquidation
  - Assumes portfolio is liquidated at the end of every measurement period.
  - Inflates after-tax return because the account is actually still investing capital that this calculation assumes has been set aside for tax payments.

A NOT Realistic After-Tax Return

- The formula pre-liquidation one period after-tax return per CFA guidelines is just the regular "Dietz" method of calculating approximate return with taxes for all realized transactions included as an expense. Notation from Simpson (2020)

$$r=(MVE-MV_B-CF-Treal) \ / \ (MVB+(\Sigma CFi*wi))$$

Where

MVE = market value of the portfolio at the end of the period
MVB = market value of the portfolio at the beginning of the period
CF = the value of funds added by the investor during the period
Treal = taxes due on investment returns from all sources
CFi = the value of an addition of funds at a particular moment in time
Wi = the fraction of the period remaining when CFi took place

A Realistic After-Tax Return

- We will just change the formula by adding an adjustment for the economic dollar value of changes in unrealized gains/losses during the period.

$$r=(MVE-MV_B-CF-Treal\text{-}A) \ / \ (MVB+(\Sigma CFi*wi))$$

- You can think of A as this period's change in the present value of the taxes that probably will have to be paid eventually when the currently unrealized gains/losses are realized.

- The adjustment accounts for legacy capital gain/losses as well as gain/losses during the measurement period
  - It does not distort the capital value

A Customized Adjustment

- The value of the adjustment amount A is:

$$A = ((UGEe - UGEb) * LTR) * (1 - Mh) \ / (1 + Yh)^H$$

UGEe = long term capital gain "equivalent" value at the end of the period
UGEb = long term capital gain "equivalent" value at the start of the period
LTR = the long term capital gain tax rate at the time the unrealized gains are realized

H = the average holding period of the portfolio
(e.g. if the portfolio has 10% a year turnover, the whole portfolio should be new in 10 years, while the average holding period is 5 years)

Mh = the decimal likelihood that the investor dies before the currently unrealized capital gain is realized (i.e. from a mortality table based on the investor age and the value of H)

Yh = the decimal yield on a Treasury bond with maturity H years from now

Finalizing Capital Gains

- For countries like the US where there are separate tax rates for short term and long term capital transactions, we combine the two types of events into a "long term equivalent amount" just for notational convenience.

  STR = decimal tax rate on short term capital gains

  UGEe = unrealized long term gains at the end of the period + unrealized short term gains at the end of the period * (STR/LTR)

  UGEb = unrealized long term gains at the beginning of the period + unrealized short term gains at the beginning of the period * (STR/LTR)

The adjustment term A will reduce the reported after-tax return if the amount of unrealized of gains in the portfolio increases over the measurement period (the taxes will usually come due eventually). The adjustment term A will increase the reported after-tax return if the amount of unrealized gains decreases during the measurement period.

Conclusions

- The commercial concept of customizing client portfolios is rapidly gaining significant traction across the asset management industry.
- Automated systems to carry out many different aspects of portfolio customization have been around for decades. Ours are used today at the scale of hundreds of thousands of portfolios.
- Most analytical methods and automation systems purporting to provide portfolio customization are extraordinarily crude. They omit many of the most rudimentary considerations of tax law and sound portfolio management.
- The biggest impediment to rapid escalation of universal customization as an industry norm (as we have in cars) is the lack of a rational standard for measuring after-tax performance. This presentation provides such a standard.