Project Study

Part of the Degree Program

Master of Science

at the TUM School of Management

of the Technische Universität München

**Never Work again – Tools to financial freedom**

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| Submitted On: | XX.XX.2021 |

**Abstract**

Lorem Ipsum Dolor sit amet….

**Glossary**

**Table 1**   
Financial Terms and Abbreviations

|  |  |
| --- | --- |
| Share / Stock |  |
| XTF |  |
| ETF |  |
| Index |  |
| Securities |  |
| Retail Investor |  |
| Short Squeeze |  |
| Efficient Frontier |  |
| Efficient Frontier Portfolio |  |
| Derivative |  |
| Future |  |
| Option |  |
| Institutional Investor |  |
| Robo-Advisor |  |
| Broker |  |
| Market Maker |  |
| Arbitrage |  |
| Sharpe Ratio |  |
| Sotino Ratio |  |
| Modern Portfolio Theory |  |
| Behavioral Portfolio Theory |  |

**Introduction**

The world of financial services is shifting rapidly. An ongoing period of low interest rates is rendering cash accounts and traditional life insurance products exceedingly unprofitable, threatening the retirement savings of many people. Various topics under the umbrella terms of ‘personal finance’ and ‘passive income’ are prominently featured in the media and an increasing number of FinTech startups is established, aspiring to disrupt the business models of established finance companies. Additionally, the cryptocurrency market, spearheaded by Bitcoin saw increasing adoption as an additional asset class over the last months. However, due to its enormous volatility and intangible nature we do not consider it as a primary way to financial freedom. New brokerage firms like Robinhood implement direct-commission-free trades on mobile phones and robo advisory firms advertise themselves as making private equity attainable for everyone. On top of that, we continue to see a rising number of ‘personal finance influencers’ publishing web content related to topics such as passive income, online entrepreneurship, ad revenue generation and especially stock and crypto trading.

Overall, people seek for new opportunities to manage and increase their personal wealth outside traditional finance media and products and face an ever-increasing supply of next generation products and services. However, this massive amount of content does not automatically guarantee users to reach their financial goals and the new FinTech products, naturally, cannot show a decades-long history of prosperity to potential customers. Additionally, given the social aspect of many digital products which new broker apps are, new techniques like mirror trading, discussion forums such as r/wallstreetbets, Elon Musk promoting stocks by posting memes on Twitter and die-hard bitcoin fans, an unusually high amount of emotionally driven investments are occuring. We are neither claiming that the stock market has always been rational, nor that bad investment advice is an invention of the internet age, but generally speaking, the amount of people sharing their opinion on certain investments and the means available to do so probably increased with the internet and social media.

This work aspires to give an overview of new offerings in the financial services industry while examining their suitability for different customers. We examine web-based techniques to generate passive income their general practicability, as well as their user fit. Additionally, we aim to classify users and explore potential cognitive biases user could have, exemplifying the latter by generating both a best-fit and worst-fit investment advice for a given user, based on the notion that products may not be classified on a one-dimensional scale from ‘good’ to ‘bad’ but instead need to be dealt with by emphasizing their individual characteristics, which may make them suitable for some of the given users while being a high-risk endeavour for others. This is done by employing a multi-method approach consisting of static analysis and a feedback loop cycle system that creates finance recommendations for users and feeds back the user’s reactions to these recommendations.

**Theoretical Background**

**New cohorts of investors**

Retail investment surged over the last years, with the corona pandemic being an additional catalyst in 2020 as Global X ETFs measured with account openings (GlobalX ETFs 2020). but retail investors cannot be considered one homogenous group. This is exemplified in the fact that both demand for rather long-term financial products like ETFs rose significantly over the last few years (Garleanu & Pedersen 2019) but also events like the internet-borne, arranged short squeeze of the GameStop Inc. stock happened. Therefore, there are evidently different investment behaviours in retail investors. We aim to categorize these subtypes of retail investors and give insights into their personal investment objectives as well as their preferred securities and financial products.

**Younger retail investors, especially young men** are drawn to use mobile app brokers, consistent with the overall trend of smartphone-based access to digital products. Most of these mobile brokers came to existence over the last few years, with the most prominent one in the U.S. being *Robinhood*, in Germany *TradeRepublic* offers a comparable product. With the rise of such companies, the brokerage firm industry experienced a shift to no-direct-commission business models, meaning that users do not pay an explicit fee for every trade they perform. This makes these brokers interesting for daytrading by retail investors, who up to then were usually disproportionally affected by fees, reducing the incentive for active trading strategies. Furthermore, newly available offerings like fractional shares which allow to invest with very small amounts are also appealing to younger customers, as their overall cash to invest is usually lower.

However, as there is no such thing as a free lunch, the question is where, if not from direct commissions, the revenue of these brokers comes from and how users may be exposed to side effects of such revenue sources.

**The number of ETF customers** increased massively since the 2008 financial crisis, alongside the overall rise of passive investment strategies. These investments are not integrally related to daytrading, which makes them attractive for a different type of retail investor, namely people who think relatively long-term, pursuing goals like saving up for a down payment on a mortgage or retirement. So-called Robo advisors usually offer ETF portfolios or other similar, highly diversified investment products which are then managed using an algorithm. The general approach is as following: A given user fills out a questionnaire during which they describe their financial situation e.g. savings, job situation, income etc. and then the user is assigned a risk classification and sold one of multiple portfolios. These usually consist of stock ETFs and bond ETFs, sometimes mixed with commodities or assets belonging to an individually set focus the user can proclaim. They market themselves as offering wealth management at relatively low fees and especially very low minimum investment amounts (0-10k€), compared to traditional private equity firms.[[1]](#footnote-2) The “robo part” is depicted as using sophisticated new technology like machine learning to optimize the customers’ portfolio. However, there is usually no fine-grained detailed information what *exactly* is being managed by an algorithm. We assume that, given the reliance on predefined ETF portfolios and the sheer number of competitors appearing, the technology is probably not *that* complicated. Additionally, it is important to distuinguish between this kind of machine learning usage and the ML and AI approaches used by institutional investors in intraday and high-frequency trading. The latter employ considerably complex models with are subject to a wide array of complex theoretical ideas as described by López de Prado in his 2018 textbook. Therefore, for the rest of this paper we define a robo-advisor to be basically an automated implementation of a classic highly diversified, long-term buy-and-hold passive investment strategy. This has mostly implications on user’s opportunity cost. For example, a user can not just do high-frequency algorithmic trading, the opportunity cost of a product offering this would therefore be low. However, selecting an ETF portfolio and occassionally adjusting it is definitely possible for (educated) retail investors. Opportunity cost are therefore higher for a product automating the latter technique for a fee.

**Cartographing the brave new world of finance**

While all these new products position themselves as more customer friendly, attainable and technologically sophisticated than the traditional financial services industry, there are indicators of various caveats in these next-gen offerings. For example, Fein (2015) found that the terms and conditions of a given set of robo advisory firms were not always in the best interest of the customer. Also, all robo-advisors were created since the 2009 financial crisis and therefore only existed under bullish market conditions, there is yet simply no data avaible how robo-advisors perform in bearish markets. Regarding brokerage, the practice of *Payment For Order Flow* (PFOF) received massive criticism after Robinhood and TradeRepublic, among others, temporarily halted only the buying of GameStop shares, while still allowing selling of these.[[2]](#footnote-3) Speculations about this being related to the businees practice that brokers route the orders of their customers to large hedge funds in exchange for commission arose shortly after. Additionally, as Battalio et al. stated in their 2013 work which was revised in 2015, PFOF can result in sub-par limit order execution from a retail investors point of view.

These statements exemplify the requirement for a further look into the business models of these new companies and how *exactly* they can help users achieve their financial goals and in which cases they may not be perfectly suitable.

**Inherent problems with the products themselves**

Apart from the aforementioned issues with internal workings of these products, there are also customer-facing aspects of tools that were identified as problematic. Firstly, it is well-understood that daytrading usually doesn’t pay off for most retail investors, as stated by Malinova et al. (2013) and Barber et al. (2013). Therefore, we consider the notion that users generally profit from high-speed, no-direct-commsion brokerage to be questionable, although the absence of directly attributable fees provides an advantage at first sight. In combination with the highly gamified experience of next-gen brokerage apps like Robinhood[[3]](#footnote-4), as pointed out by <citation>, the question arises whether, on average, these products actually provide users with the right toolkit to achieve their personal wealth goals. Additionally, an evaluation is required whether conflicts of interest stemming from the broker’s PFOF business model exist and what measures need to be conducted on the user’s side to prevent them from negatively impacting the user’s financial goals.

**Other sources of passive income**

While investing outlines a feasible path to passive income (e.g. living off growth and dividends), there are also other ways to achieve passive income, mostly based on creating and selling some sort of digital content on the internet. Advocated for by an ever-increasing number of ‘personal finance influencers’ publishing financial advice of, presumably, varying quality on social media and platforms such as Medium, Youtube, Blogs, Instagram and even TikTok[[4]](#footnote-5). These people usually promote methods like generating ad revenue through blogs or videos, selling courses or other digital goods and also give tips related to stock or cryptocurrency trading. Given the fact that these media channels target people who are not financial industry professionals or scholars, the question of both quality of the advice and to which degree these people monetize the advice itself - creating a closed system in doing so- arises. Furthermore, it is possible that there is a certain degree of survivorship bias present in the group of personal finance influencers, e.g. the people who had success claim this to be the result of their specific actions while they may have just been lucky. Finally, for these non-financial methods of accumulating passive income, the individual market and personal conditions are more relevant than they are for stock trading. For example, someone who studied marketing may have an easier time setting up a profitable Instagram channel than a factory worker.

Therefore we propose the research assumption that these non-financial ways to passive income are less plannable, compared to stock / ETF trading and require a more specific effort by the user, combined with a certain degree of luck. We assume that for any user aspiring to choose this path, a more thorough previous analysis of their personal skills, experiences and life situation is required, off-the-shelf products as in stock trading are not generally available.

This lack of off-the-shelf approaches creates the need for a systematic overview of these potential alternative ways to financial freedom.

**Biases and interest to manipulate user’s investment behaviour**

In order to guide users towards financial freedom, using the right tool is not everything. There is an ongoing discussion to what extent users are affected by the various cognitive biases. As Loos et al. (2020) point out, users are inattentive and are affected by the so-called disposition effect, the tendency to sell winning stocks and hold on to losing ones. Additionally, they discovered that even consumption is financed by selling winners. Therefore, the opportunity cost of missing future gains of a winner are combined with a cash outflow, further reducing investment opportunity. Koestner et al. (2017) state that users have a tendency to under-diversify and that trading experience negatively correlates with portfolio turnaround.

**Utility functions and personal finance**

Apart from the aforementioned ‘soft’ factors like cognitive biases, individual goals, gamification and impulse actions we also consider ‘hard’ portfolio theory based on math and economics to be relevant. The concept of a personal utility function as a mathematical way of measuring the positive impact of something to a user is at the core of this. There has been a lot of research regarding different types of utility functions indicating, among other things, that there is no one-fits-all utility function. To exemplify, Friedman and Savage proposed in their 1948 paper that curvity of an individual’s utility function may change with their personal wealth on the example of gambling and insurance. Although placing critique on Friedman and Savage’s 1948 work, Markowitz (1952a) also generally states a non-linear utility function of an individual, separated in concave and convex elements, with the concave parts being located in the extreme regions of wealth (e.g. rich and poor) and the convex part in between them. The implications for this work include that risk preferences may differ with given levels of wealth, therefore they need to be actively incorporated into a personal finance product or technique recommendation. Furthermore, the general notion that there’s no one-fits-all utility function spawns the requirement to carefully select a certain function to numerically display a suitable recommendation for a given user.

**Modern Portfolio Theory**

Investment recommendations to users imply the need for thought regarding portfolio composition theory. Most Portfolio selection efforts are based on the Mean-Variance or so-called modern portfolio theory proposed by Markowitz in another (b) 1952 work. It forms the basis of most later work in portfolio selection methodology and is built on the idea that an investment’s respective risk and return profile may not be viewed in isolation. Instead, a single investment’s impact on the overall portfolio is considered of interest. This forms the baseline idea for diversification and, in consequence, highly diversified ETFs. As in turn ETFs form the baseline for most robo-advisors, it is more relevant than ever for our given work. It is important to note that MPT is based on quantitative characteristics and assumes rational investor behaviour, similar to many other economic models. MPT generally considers investors to be risk-averse and defines the overall goal as maximizing returns for a given level of risk.

**Behavioural Portfolio Theory**

Extending on the then-available portfolio selection theory while adding a notion of not perfectly rational (e.g. not totally risk-averse) investors, Shefrin and Statman introduced behavioural portfolio theory (BPT) in their 2000 work. It incorporates, among other ideas, the prospect of investors having multiple so-called mental accounts. This depicts the idea that there are no unidimensional investment goals, but multiple, each with a different intrinsic desire for risk. The classic example (insert citation here) is the separation of retirement savings with low appetite for risk combined with a more aggressive sub-portfolio that provides the investor with an opportunity to acquire life-changing wealth through risky financial decisions. Therefore, a major difference to MPT is that investors do not have a uniform risk level preference in BPT. This is consistent with the observation made by Friedman and Savage in 1948, namely people buying both insurance and lottery tickets. For the given paper this implies that when recommending an investment strategy to a given user, in order to have the user stick with the approach over a long enough timeframe, it may be beneficial to deviate from numerically optimal portfolio allocation, adding a physical representation of the user’s second mental account e.g. adding a more risky / experimental sub-portfolio which provides the possibility to reap vast returns.

**Combining both approaches**

MPT and BPT may seem contradictory to each other given the above initial descriptions, however, later work by Das et al. (2010) proved a mathematical way to set the problem statements of portfolio optimization with MPT and BPT equal. While the exact proof is omitted here, the notion that portfolio optimizations on both the more quantitative and “institutional” MPT and the more “personal” BPT are possible, implies for this work that achieving the personal finance goals of a given user by employing a baseline MPT approach for the general strategy, but overlaying it with measures from BPT in order to fine-tune the overall result according to individual goals may be attractive.

Accordingly, as users intuitively value portfolios which also incorporate behavioural aspects higher than entirely mathematical-rational ones, we create the research hypotheses that users require a behaviouristic component to any personal finance recommendation in order for the users to stick with the recommendation over the relatively long term that is usually required for building wealth.

Furthermore, as we see investment decisions to be at least partially driven by emotions and personal finance products systematically exploiting them through gamification, access to leverage and promotions, we define the research assumption that users require meta-education on the products they may be utilizing in order to avoid pitfalls on the path to financial freedom.

**Conclusion and overall research goal**

The combination of new financial tools which yet have to prove themselves in the long run, the discrepancy between investment theory and consumer behaviour and the myriad of potential ways acquire wealth lead to our central research question. Namely how and to what extent it is actually possible to create a personal finance recommendation for a given user that

1. Incorporates established portfolio theory
2. Minimizes pitfalls induced by cognitive biases and flaws in the tools used
3. Suits or even capitalizes on the user’s skills, experiences and life situation
4. Is designed in a way that allows enough “behavioural wiggle room”, so users actually stick to it long enough for compound interest to unfold.

**Methodology**

**Research design overview**

This work follows a multi-method approach combining different qualitative approaches. The core idea is that we neither try to quantitatively confirm the existence of certain cognitive biase nor do we intend to find the ‘perfect’ recommendation for a user. We develop a questionnaire-fed recommendation and education engine based on theorical concepts which we then evaluate using qualitative interviews with a limited number of users. This creates a feedback loop that common sales-oriented product recommendation engines do not possesss.

We aim for enabling conscious decsions by providing direct education on financial services products but also meta-information on the products themselves and the markets they are operating in. We highlight cognitive biases by incorporating theoretical research into a questionnaire that allows users to self-assess. Regarding non-financial financial freedom methods, we provide an overview of what’s theoretically possible in terms of income ideas and their mean payoff and emphasize the need for the user to self-reflect on their skills. Finally the consolidated results are displayed to the user in a personal finance dashboard.

**Researcher descriptions**

Both authors are M.Sc. students in Management & Technology at the TUM School of Management, specializing in Finance and Computer Science. We both invest in shares and ETFs.

**Static analysis and tool clustering**

For the initial overview and clustering over various personal finance tools we employ techniques of static, systematic analysis of tools which mostly rely on existing literature, web search, punctually enhanced by manually trying certain products ourselves. However, as the latter approach is too time-consuming for all products in scope of this paper, it was only used for a small group of ‘lighthouse’ products with a relatively high market share and visibility. This means mentions in the press (Wall Street Journal, FastCompany etc.), but also on social media (Reddit, Twitter) and Google search term popularity. As a consequence of this approach, we explicitly do not consider the detailed fee amounts of, for example, robo-advisors as this information can change anytime and is cosidered to be sales-oriented. Instead we focus on the more general characteristics of products like their fee *structure*, business model, target demographic, usage concept, attainability and owner / partner structure.

**Simple user questionnaires**

In order to acquire the initial data for a given user, which is required for creating any investment recommendation, the users fill out a simple questionnaire consisting of eight questions. These questions are taken from the Financial Health Score <citation here> with slight modifications. They capture the baseline financial situation of a user, namely income to expense ratio, debt, savings as well as their general life situation. This mostly sets the grade of flexibility for a user’s financial decisions. Simply put, if there is no monthly surplus in a household, details of portfolio theory are of minor concern. This information serves as the baseline for any further recommendation and measures the impact of these. We classify users into five groups, depending on their numeric score:

|  |  |
| --- | --- |
| Score region | Financial Situation |
| 0-20 | Impoverished |
| 20-40 | Precarious |
| 40-60 | Average |
| 60-80 | Established |
| 80-100 | Robust |

Generally speaking, the category points at both the possibility and the requirement to systematically work on a users financial situation. It also implies the extent to which a user is able to bear risk. The numeric score is not immediately presented to users, but used for internal calculations. As users later on are asked to gauge finance recommendations, we aim to infere with their self-perception as little as possible.

**Detailed questionnaire and recommendation rating**

After these initial inquiries, users were presented more specific questions on their financial experience and behaviour.

The users were then asked to rate these recommendations, not knowing which is which.

**Cognitive bias analysis questionnaire**

This part of the user input is designed to estimate the user’s rationality and ability to “keep their cool” in the financial markets or during an entrepreneurial endeavour.

**Technology**

We use open-source technology to implment and deploy the recommendation engine and the personal finance dashboard.

**Testing research assumptions**

The questionnaires and recommendation engine are based on the aforementioned research assumptions. While we do not conduct full-scale quantitative testing of these assumptions, the described feedback loop

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1. Historically, “private equity-rich” meant a nine-digit net worth. [↑](#footnote-ref-2)
2. As opposed to a complete buy and sell trading freeze. [↑](#footnote-ref-3)
3. For example, virtual confetti is thrown after conducting trades. [↑](#footnote-ref-4)
4. If you feel old reading this, the authors are in their early 20s and do so as well. [↑](#footnote-ref-5)