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The Adoption of Robo-advisory in the Swedish Financial Technology Market

Analyzing the consumer perspective

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Abstract

Due to the digitalization revolution within the financial sector fintech companies are challenging the traditional banking institutes with new technologies and innovations. Robo-advisors are the new way to get personalized investment services online instead of using traditional advisory. The aim is to research the consumer adoption of robo-advisory in the Swedish financial sector. Additionally, the core emphasis throughout this thesis is on; consumers personal traits, as well as behavioral factors that impact consumers investment decision. Theories used are mostly innovation theories and behavioural theories. To investigate the aim a quantitative approach is used and a survey with 435 respondents were conducted and two probit and margin regressions was made, one for securities as the dependent variable and one for robo-advisory as the dependent variable. The results show that the adoption of robo-advisory has been slow in Sweden due to lack of transparency and information. Lastly, gender was the most significant factor in both regressions.

Keywords: Robo-advisory, securities, fintech, innovation, technology adoption

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Sammanfattning

På grund av digitaliseringen inom finanssektorn utmanar fintech företagen de traditionella bankinstituten med ny teknik och nya innovationer. Robotrådgivare är det nya sättet att få personliga investeringsråd istället för att använda traditionell rådgivning. Syftet är att undersöka konsumenternas uppfattning kring robotådgivning i den svenska finanssektorn. Uppsatsen kommer baseras på konsumenternas personliga egenskaper samt beteendemässiga faktorer som påverkar konsumenternas investeringsbeslut. Teorierna som används är innovationsteorier och beteendeteorier. För att undersöka frågeställningarna har ett kvantitativt tillvägagångssätt använts. En enkätundersökning genomfördes som resluterade i 435 respondenter. Datan från enkäten analyserades via grafer samt två probit regressioner med olika beroende variabler, värdepapper samt robotrådgivning. Resultaten visar att adoptionen av robotrådgivning har varit

långsam i Sverige på grund av bristande transparens och information. den mest signifikanta faktorerna i båda regressionerna var kön.

Nyckelord: Robotrådgivning, värdepapper, fintech, adoption av teknologi

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CHAPTER 1

Introduction

The intention of this chapter is to introduce the thesis topic and to present underlying background and problem regarding the phenomena of robo-advisors. Furthermore, the aim and research questions will be presented followed by the contextual setting of the research.

1.1 Background and Problem Statement

The financial industry is currently undergoing remarkable development; new technology and digitalization focus are creating paths for revolutionizing innovations which has led to changes in this industry. The interaction between the financial industry and technology has created fintech which is defined as *''A global phenomenon, born at the intersection between financial firms and technology providers, attempting to leverage on digital technology and advanced analytics to unbundle financial services and harness economies of scale by targeting long-tail consumers." (Sironi, 2016, p.5)*

The digitalization revolution are challenging traditional banking institutions who have been forced to remodel a part of their businesses to adapt to these changes, starting with their digitalization developments. The fintech firms are leading the way with new innovations using behavioral and big data analytics. Changes are also seen in new customer behaviors which demand flexibility, digital solutions and more personalized investment propositions such as Goal Based Investing (GBI). GBI is placing

the individual at the center of the investment decision-making process has and by doing so, the financial industry has changes. (Sironi, 2016)

At the same time, new regulations such as Market in Financial Instruments Directive (MiFID I and II), which regulate the securities market in countries within the European Union, are coming into force. The demand for transparency in the financial industry are reducing asymmetry of information that has been dominating. Information asymmetries between customers, professional bankers and advisors have given financial institutions the upper hand when it comes to pricing which made wealth management organizations focusing on short-term cost/income ratio optimizations instead of their customers long-term interest. (Sironi, 2016) This among other events contributed to the global financial crisis in 2007 which indicated that type of behavior was not sustainable in the long run. However, the approach in the financial industry is changing from asset management centrality to a more client focus approach. (Sironi, 2016)

In the era of robo-technology, a combination of digitalization and GBI focus has developed the fintech innovation robo-advisory within the financial industry. This innovation is categorized as disruptive innovation since it challenging existing type of traditional advisory, appealing new customers and creating a new need within existing customers. Robo-advisory is also easier to access and cheaper than traditional advisory. Traditional advisory target customers have been wealthier clientele creating a gap for small savers due to the fact that the revenue potential of these type of customers was considered too small for many traditional advisors. Robo-advisors are filling that gap by offering investment service to low income millennials who are considered as small savers initially, but has spread to wealthier customers as well. (Sironi, 2016) The definition of robo-advisory is:

‘’*Robo-advisors are automated investment solutions which engage individuals with digital tools featuring advanced customer experience, to guide them through a self-assessment process and shape their investment behaviour towards rudimentary goal-based decision-making, conveniently supported by portfolio rebalancing techniques using trading algorithms based on passive investment management (associated with mutual and exchange-traded funds where the fund's portfolio mirrors a market index) and diversifications strategies. These digital businesses differentiate by de-*

gree of passive management, depth of investment automation, interaction between human advisors, and level of self-assessment, as well as target clientele." (Sironi, 2016, p.8)

Robo-advisory was first introduced in the US in 2008 where having a financial advisor is quite common and US is still the biggest market for robo-advisory. A report from A.T. Kearney in the U.S. claims that robo-advisory services will become frequently used over the next three to five years among American investors and the adoption rate of robo-advisory will increase. The total invested assets in dollars within robo-advisory was estimated to increase from 1,7% in 2017 to 5,6% in 2020. (AT Kearney, 2015) Identified characteristics of current robo-advisory users tend to have previous experience in investments and modern technology. These type of consumers are also wealthy and risk-takers. (Epperson, Hedges, Singh and Gabel, 2015) Even though robo-advisory service is relatively new phenomenon and are still in the growing phase with huge development potential there are many companies in Sweden offering this type of services. There are presently ten different robo-advisors and many more are on its way. (Di Digital, 2017)

Robo-advisory could reduce information asymmetries when collecting data on the customer's financial situation and at the same time building a knowledge base for customer input. Simultaneously, the customer can gather and process information about the robo-advisory process. Problems can appear when the collection of information are too rigid and customers and advisors are forced to completeness. This could cause information overload and thereby lead to information asymmetries. (Kilic, Heinrich and Schwabe. 2015; Nussbaumer, Matter, á Porta & Schwabe 2012a, b)

The concept artificial intelligence (AI) is often associated with robo-advisory. It refers to machines performing tasks in ways that simulate human intelligence. These machines have the ability to learn, solve problems, rationalize and choose the best solution possible to achieve specific goals (Nilsson, 2014). Companies offering robo-advisory services are integrating AI in their robo-advisors to make them smarter by self-learning AI investment algorithms. (Deloitte, 2016) Due to robo-advisory services still being in the early phase, there are also several critical views towards this innovation. Many deficiencies have been identified with the current service offered today on the Swedish market. Among other

things, present robo-advisors do not collect sufficient information to give comprehensive advice and do not cover all aspect of one's personal economy. (Morningstar, 2017)

Although robo-advisory is a revolutionizing, the adoption of this innovation has been slower than expected. A study from the US shows that this can be due to consumers questioning robo-advisories usability, low trust in banks and high expectation of transparency. (Jung, Dorner, Veinhardt and Pusmaz, 2017)

1.2 Purpose and Research Question

The aim of this thesis is to research the consumer adoption of robo-advisory in Sweden where research has been quite limited so far. Robo-advisory was first introduced in US and a report from 2015 presents that 20% are aware of robo-advisory services and the adoption of robo-advisory equals to 3% in the US. Furthermore, this thesis aims to contribute to a growing body of literature that explores the importance of the future of robo-advisory in the fintech industry in Sweden. Our research also investigates consumers personal traits and behavioral factors that impact the investment decisions. The personal trait refers to gender, age, education, income, risk. The behavioral approach refers to factors that impact behavioral intention and behavior use of technology, such as consumers perceptions, effort expediencies and performance expediencies. The target group are consumers who invest in securities and potential consumers in the Swedish financial market.

There are two main questions this thesis wishes to investigate:

1. Has robo-advisory been adopted in Sweden and what attitudes do consumers have towards robo-advisory on the Swedish financial market?
2. Which personal traits and behavioral factors impact the consumers decision to invest in securities and via a robo-advisor?

1.3 Limitations

This thesis was conducted under a period limited of five months and since the problem analyzed is complex some limitations were needed. The thesis focuses on the Swedish market and is limited to the financial sector regarding robo-advisory. Furthermore, the angle we address are the customers perspective and will not take the financial institutes or providers of robo-advisory perspective into account. This quantitative research investigated the Swedish financial market only and the survey that was conducted was in Swedish, excluding other nationalities living in Sweden.

1.4 Sustainability

The definition of sustainability is defined by OCED as following " the use of the biosphere by present generations while maintaining its potential yield (benefit) for future generations; and/or non—declining trends of economic growth and development that might be impaired by natural resource depletion and environmental degradation". (OCED Glossary of Environment Statistics, 2003)

This thesis focus on the consumer perspective and not the robo-advisory providers perspective. Therefore, sustainability issues are not directly related to the thesis area. However, this thesis illuminate a social economical sustainable development through researching robo-advisory as being a part of the financial market. Innovations are the driving force of economic development and growth (Schumpeter, 1939) and robo-advisory is an innovation that could contribute to this type of development. Robo-advisory also implies new opportunities for new firms and financial advisory market. Developing the innovation robo-advisory decreases the possibility of asymmetric information due to reducing human advisors incentives to invest based on personal interests. (Madhani, 2010) This benefits the consumers in the financial market and contributes to a social economical development.

1.5 Outline

In the theoretical framework and literature review section relevant theories are presented and will represent the theoretical base for the case study. Literature review illustrates earlier studies regarding robo-advisory, other innovation similar to robo-advisory development and some criticism are presented. The intention of the chapter is to build the structure for the empirical analysis. Secondly, the methodology section motivates how the research was conducted by describing the research through approach, method and data collection. Furthermore, the chosen variables are described and motivated followed by descriptive statistics. The chosen research type and process are motivated in this chapter. In the empirical analysis chapter a presentation of the empirical findings based on the survey is made. Thereafter, an analysis will be completed and connected to the literature framework. The purpose of this chapter is to discuss and examine the research leading up to the conclusions of the findings. In this chapter the main findings of the research are summarized. Lastly, in the conclusion section the main findings of the research are summarized followed by recommendations for future research.

CHAPTER 2

Theoretical Framework and Literature Review

This part will highlight previously conducted research within relevant fields of study in order to be able to answer the research questions. The literature presented in this section will help the study to support the adoption of robo-advisory. The theories describe the consumer innovation adoption process and consumers intention and usage behaviour. The intention is to explain how different personal traits affect individual's choice to adopt or not adopt an innovation. Furthermore, the theory of asymmetric information illustrates the problem within the financial market regarding financial advisory. Lastly, a literature review will present other relevant earlier studies made.

2.1 Innovation theories and innovation adoption lifecycle

Innovation is a well-known concept including different perspectives and definitions. An innovation could be defined as a new product or service, new processes or a new approach to a problem. (Gorman, 2007) Innovation challenges existing techniques and approaches, thereby being important for economic development since it can lead to a temporary market position which probably include higher revenues and foster competition between actors. (Schumpeter, 1934)

2.1.1 Schumpeter's innovation theory

Joseph Schumpeter explains that economic development are significantly driven by innovations. Innovations are a crucial factor for competitiveness, economic change and profit gaining. He also describes that innovation causes *''the gale of creative destruction"*, which is a *''process of industrial mutation, that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one"* (Schumpeter, 1942/1976, p.83).

There are five types of innovations (Schumpeter, 1939):

- Launching a new product or a new quality of a product
- Applying a new method of production
- Opening of a new market where the industry has not previously entered
- Obtaining a new source of supply half manufactured goods or raw material
- Creating a new industry structure, such as creating or destroying monopolies

The invention phase of an innovation does not have the essential impact on economic growth. However, the diffusion process of that innovation where imitators recognize the profitability of the new innovation and begin to make major investments in its technology have a huge impact on economic growth and employment. While innovations drive economic growth, the entrepreneurs are essential innovators creating the innovations. The entrepreneurs allocate current resources to new combinations and uses. (Schumpeter, 1939)

Neo-Schumpeterian economics, which seeks to explain the dynamic phenomena in economics, focuses on knowledge, entrepreneurship, novelties, innovations at the micro-level. Innovations are the core principle in the Neo-Schumpeterian approach, where price competition is replaced with innovation competition, which generates growth. (Hanusch and Pyka,

2006) New innovations replace old technologies, i.e. creative destruction. This process is the essential force that drives innovations and generate productivity growth. Innovations that lead to growth are generally connected with higher turnover rates which indicates higher rates of creative destruction of firms and jobs. In other words, there is a positive correlation between competition and growth. (Aghion, Akcigit and Howitt, 2013)

Competition and entry stimulate innovation and productivity growth between incumbent firms. This is common especially among firms that compete *neck-and-neck*, i.e. competition between firms that compete closely, and firms near the technology frontier. There is an inverted U-shape between competition and productivity growth, where higher competition induces innovation and growth when starting with a low level of competition initially, and higher competition affects innovation and productivity growth negatively when starting with a high level of competition initially. Patent protection also stimulate innovations and investing in R&D among firm in the market. (Aghion, et. al., 2013)

2.1.2 Sustaining and disruptive innovations

Innovations can be sustaining or disruptive. Sustaining innovation improves existing product, in quality, performance or price, instead of creating new markets or value. (Christensen, 1997) In contrast to sustaining innovation there is disruptive innovation. A disruption technology is the evolution of a product or service over time. (Christensen, Raynor & McDonald, 2015) Disruptive technology is inventing or reinventing technologies and products which creates new markets, adds new value and attracts new customers. (Christensen, 1997) A disruptive innovation, by definition, typically starts in two different types of markets that incumbent usually overlooks. The two markets are either a low-end footholds or new-market footholds. The definition of a foothold is a firm basis for further progress or development. The low-end foothold market serves those customers who are looking for a more affordable product or services than the current market offers. (Christensen, Raynor & McDonald, 2015) Disruptive technology may underperform initially when it comes to performance dimensions that mainstream customers' value historically.

Nevertheless, the new innovation performs better on a secondary performance dimension. Existing firms in the market reject the disruptive product initially because it require improvements and the products are either commercialized in niche or developing markets or approaches the low-end market with lower-priced products. Disruptive technology also add additional performance dimensions that current products do not have such as usability, price, suitability, mobility and size. The disruptive technology will improve over time and mainstream customers will start adopting the new product. Customers will replace the old technology with the new technology and entrants will eventually replace incumbents in the market. (Christensen, 1997)

Disruptive technology has been replaced by disruptive innovation. Instead of focus on a new type of technology the major focus are towards a company business model which creates opportunities to disruptive innovation. The definition of disruptive innovation is how radical products produced by new companies since new products often requires a different business model. It is possible for incumbents to succeed with a radical product by two conditions, understanding of changes within the business model and make the employees aware of new approaches. (Johnson, Christensen & Kagermann 2008)

2.1.3 Innovation Adoption Lifecycle

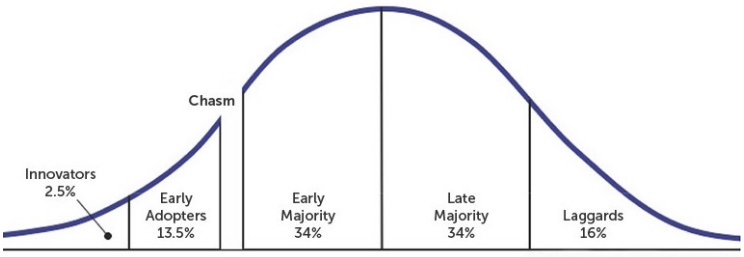

Figure 2.1: Technology Adoption Life Cycle (Rogers, 2005, p.247)

Consumers react to new innovations differently and how fast the consumer adopt new technologies can be described by the *''Technology Adoption Life Cycle (TALC)"*. (Moore, 1991) This model is demonstrated as a normal distribution curve and consumers are divided into five segments: innovators, early adopters, early majority, late majority and laggards.

Innovators are the fastest group to adopt a new innovation. They are young technology enthusiast and more risk-oriented with innovators and scientists in their network. The second group to adopt a new innovation are early adopters. They are opinion leaders and visionaries with higher social status and education. Their financial status is also higher. The third group are early majority, who are slower at adopting new technologies than innovators and early adopters. They have lower level of social status and opinion leadership. The fourth group of consumers are the late majority who are more skeptic to new technology. They are often older and less educated. Their financial and social activity levels are also lower in comparison to the first three groups. The last group to adopt new technology is laggards who are very skeptic to new innovations and do not prefer change. They are the oldest of all other consumers with lowest level of education and financial status. This segment also have very low opinion leadership and social activity. Innovators and early adopters are interested in the technology and its performance while early majority, late majority and laggards are more interested in practicality and solutions. (Moore, 1991)

This model is important to take into account when developing new products and services. The most difficult stage for businesses are shifting their new technology from early adopters to early majority which is the goal for many firms, this change is called ‘’The Chasm”. Overcoming that stage will make the new innovation mature and used by the majority of the consumers in the market. (Moore, 1991)

2.2 Technology Adoption Models

There are several theories that can help explaining the reasons behind individuals’ technology adoption by describing different factors that impact the adoption process and technology usage. These theories describe different factors that determine individuals’ behavioral intention and actual usage of technology. The most substantial theories within this research are explained below.

2.2.1 Technology Acceptance Model (TAM)

This model explains and predicts technology acceptance and technology usage. It is also the first model that mentions psychological factors impact on technology adoption. TAM describes that the factors *perceived ease of use* and *perceived usefulness* which are affected by external variables control a person's attitude and intention to use the technology which determine the actual usage of the technology. Perceived ease of use also affect perceived usefulness directly. Perceived ease of use refers to *"the degree to which a person believes that using a particular system would be free from effort"*. (Davis, 1989, p. 320) Perceived usefulness is defined as *"the degree to which a person believes that using a particular system would enhance his or her job performance"*. (Davis, 1989, p. 320) TAM was developed through the Theory of Reasoned Action (TRA) which is explained further below. (Davis, 1989)

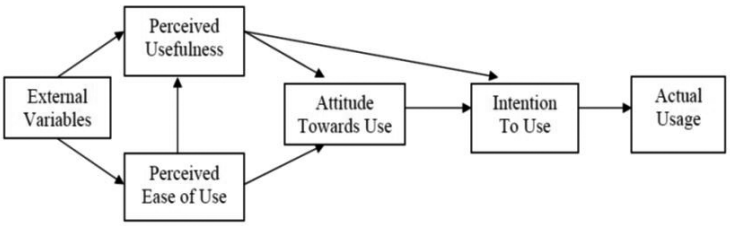

Figure 2.2: Technology Acceptance Model (Davis, 1989, p.985)

2.2.2 Theory of Planned Behavior (TPB)

TPB describes that *attitude toward behaviour*, *subject norm* and *perceived behavioral control* impact an individual's intention of doing a desired act and execute the actual act. Changing these factors will increase the intention and actual behaviour. The accessibility of resources, opportunities and skills and the perceived importance of those resources, opportunities and skills will affect the desired outcome. Attitude towards behaviour refers to the degree to which an individual has negative or positive feelings of the particular behaviour. It involves a consideration of the performing behaviour outcome. Subject norms are defined as the belief of whether other people think that the individual will perform the behaviour. It

refers to an individual's perception of the social environment around a certain behaviour. Perceived behavioral control is related to an individual's perception of whether the performance of a behavior is difficult or easy. Perceived increase of resources and confidence increases the perceived behavioral control. Behavioural intention refers to an individual's motivation in the reason of that individual's conscious decision to perform a particular behaviour. The stronger the intention is, the higher probability the behaviour will be performed. (Ajzen, 1991)

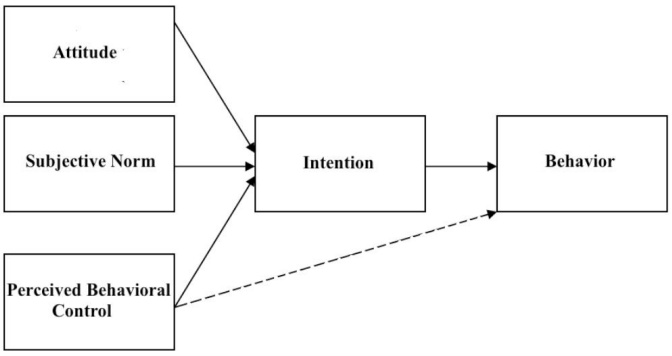

Figure 2.3: Theory of Planned Behavior Model (Ajzen, 1991, p. 182)

2.2.3 Combined TAM and TPB (C-TAM-TPB)

In contrast to TAM, TPB takes control and social factors into account when predicting intention and behaviour. Therefore, the researchers Taylor and Todd (1995) combined these two models and added *perceived behavioral control*, *attitude* and *subjective norm* to TAM. By doing that they created a model that is more comprehensive in explaining technology adoption. TAM is easier to apply, have minor empirical advantage and provide general information on user's system opinions. TPB supplies more specific information and can better motivate development. This combined model can be applied to individuals with experience within technology systems as well as individuals without experience within technology systems. (Taylor and Todd, 1995)

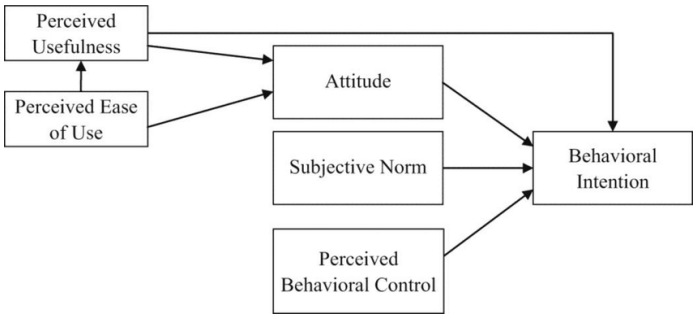

Figure 2.4: Combined Technology Acceptance Model and Theory of Planned Behavior Model (Taylor and Todd, 1995 , p. 562)

2.2.4 Innovation Diffusion Theory (IDT)

IDT describes the innovation decision process and the technology acceptance process. It has been applied at organizational and individual level and explains the reasons for new technology spreading and at what rate they do that. Rogers (1995) identifies four main components that impact the spread of a new technology: *time*, *communication channels*, *the innovation itself* and *a social system*. The time aspect of the process of diffusion innovation involve rate of adoption and categorizing adopters. It records the pace of innovation diffusion in society and adoption by various users. The process is demonstrated in The Adoption Life-cycle (Rogers, 2003) and TALC (Moore, 1991) mentioned in section 2.1.3. The communication channels are used by users to share information with each other. An effective communication system provides a faster innovation diffusion process. Rogers (1962) mentions two types of communication channels: mass media and interpersonal channels. Information can be shared faster with mass media, however the interpersonal channels are more essential for the diffusion of a new innovation or technology. The innovation itself is defined as an idea, object or practice that is perceived as new by individuals. The product or service can be completely new or old but is perceived as new in terms of use. An innovation is not useful unless it is accepted in a social system. If the society fails to recognize an innovation, it will fail to be one. The diffusion of innovation occurs when the social system adopts the innovation and shares information about the innovation within the system and with other systems. (Roger, 2003) The innovation has to be communicated over time among members in a social system and adopted widely in order to self-sustain. (Rogers, 1962)

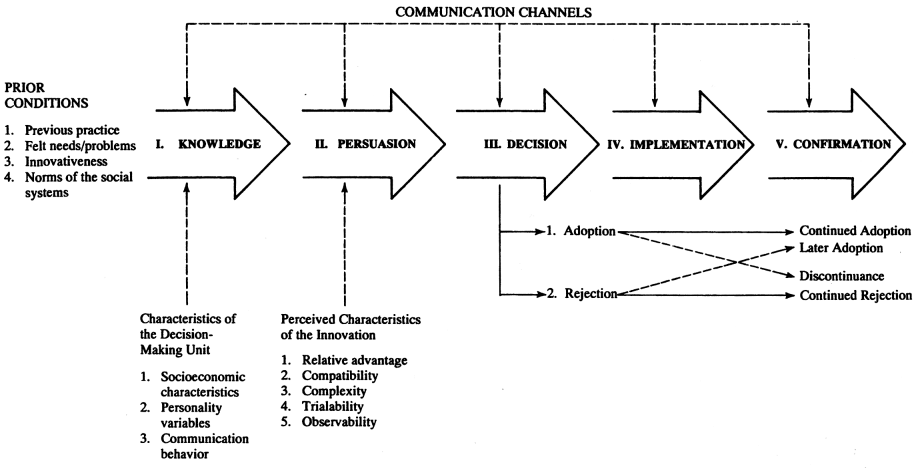

Figure 2.5: Innovation Diffusion Theory Model (Rogers, 1962, p. 165)

2.2.5 Theory of Reasoned Action (TRA)

This model conveys the relationship between behaviours and attitudes regarding action that humans pursue. TRA assume the best predictor of a behavior is behavioral intention, which in turn is determined by *attitude toward the behavior* and *subjective normative perceptions* regarding it. Attitude and subjective norm explains a large proportion of the variance in behavioral intention and also predict a number of different behaviors. Current attitudes and behavioral intentions which create motivations impacts an individual's actions and the individual will behave in a certain way based on the expected outcomes that the particular behavior will result in. Positive expected outcome of a technology usage increases the chance of choosing to use that technology. (Fischbein and Ajzen, 1975)

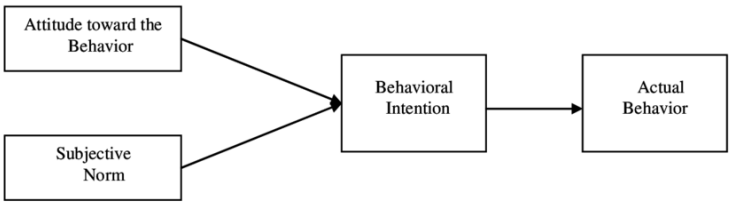

Figure 2.6: Theory of Reasoned Action (Fischbein and Ajzen, 1991, p. 321)

2.2.6 Social Cognitive Theory (SCT)

Through the social cognitive theory Bandura (1986) explains that an individual's behaviour are determined by environmental, cognitive and personal factors such as social pressure, personality and observing others. Many behavioral and social theories focus on individual, social, and environmental factors that define an individual or a group. SCT explains that human behavior is the product of the dynamic interface of personal, behavioral and environmental influences. Furthermore, SCT focuses on humans potential abilities to change and construct environments in order to suit the purpose they create for themselves. An individual's behaviour are affected by observing others behaviors. SCT also introduces two cognitive factors that guides behavior; expectations and self-efficiency. The chance is higher that individuals carry out behaviors that they believe will have a positive outcome and avoid behaviours with negative outcome. Self-efficiency is an individual's belief of the ability to execute a certain behavior. (Bandura, 1986)

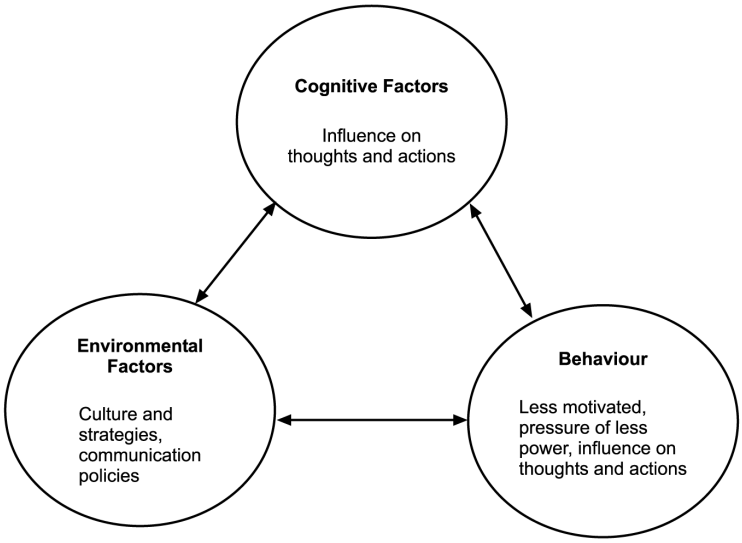

Figure 2.7: Social Cognitive Theory Model (Bandura, 1986, p. 362)

2.2.7 Model of PC Utilization (MPCU)

This theory was presented by Thompson, Higgin & Howell (1991) and is based on the Theory of Human Behaviour by Triandis (1977), which

presents that individuals' behaviour are determined by attitudes, social norms, habits and expectations. Therefore, individual behaviors are determined by what they would like to do, what they think they should do, what they usually have done and their expected outcome of that behaviour. According to MPCU perceived consequences, affect toward use, social factors and facilitating conditions affects PC utilization. Perception results include job-fitness, complexity and long-term consequences. This theory is mainly used to predict PC utilization behaviour but are also used to predict adoption and usage of technology. (Thompson Higgin & Howell, 1991)

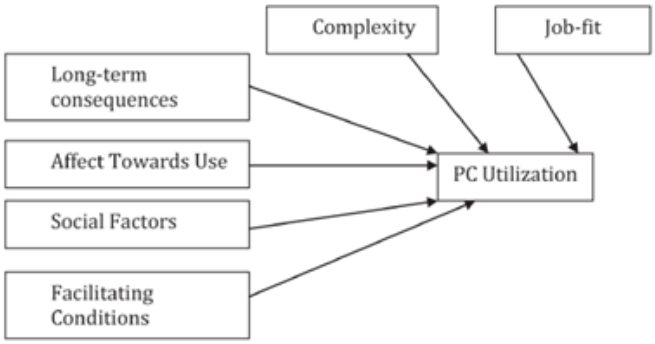

Figure 2.8: Model of PC Utilization (Thompson, 1991, p. 131)

2.2.8 Motivational Model (MM)

The motivational model includes two types of motivation that impact behavioral intention: intrinsic and extrinsic. Intrinsic motivation refers to performing an activity for the enjoyment rather than having the desire of an external reward, the behaviour itself is the reward. Having an enjoyable technology experience is essential for increasing the intention of using that technology. Extrinsic motivation also impacts the intention of using technology and refers to performing an activity to gain a reward or avoid an adverse outcome rather than engaging in that activity to enjoy it. Intrinsic motivation may be seen as the more favorable type of motivation, however it is not a possible choice in every situation where individuals do not have internal desires to engage in certain type of activities. Excessive rewards can be problematic, but extrinsic motivators can be valuable

tools when used appropriately. (Davis, Bagozzi and Warshaw, 1992)

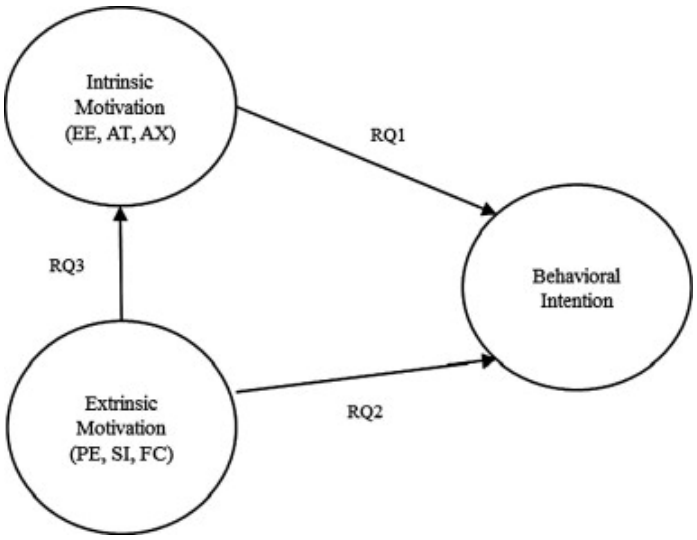

Figure 2.9: Motivational Model (Davis, Bagozzi and Warshaw, 1992, p. 1125)

2.2.9 Unified theory of acceptance and use of technology (UTAUT)

The unified theory of acceptance and use of technology (UTAUT) was developed by Venkatesh, Davis, Davis and Morris (2003) with the aim to create a unified model that connects alternative views on user and innovation acceptance. UTAUT is the most comprehensive model to predict technology acceptance. It is based on eight models within technology adoption research (Technology Acceptance Model TAM, Theory of Planned Behavior TPB, Combined TAM and TPB, Innovation Diffusion Theory, Theory of Reasoned Action, Social Cognitive Theory, Motivational model and Model of PC Utilization). These contributing theories and models have been used within technology and innovation adoption in different areas such as information system, marketing, social psychology and management. However, the UTAUT model outperforms these eight models in describing determinants of usage intention and explains 70% of the variance in behavioral intention to use technology. According to this model, there are four direct determinants of behavioral intention and use behavior:

- `Performance expectancy`: ''The degree to which an individual

believes that using the system will help him or her to attain gains in job performance" p. 447

- `Effort expectancy`: ''The degree of ease associated with the use of the system" p. 450
- `Social Influence`: ''The degree to which an individual perceives that important others believe he or she should use the new system" p. 451
- `Facilitating Conditions`: ''The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" p. 453

Researchers and practitioners can be able to assess an individual intention to use a specific system by examining the presence of these determinant in a "real-world" environment. By doing so, influences on acceptance in a given context can be identified. There are also four variables that have impact on these four determinants; gender, age, experience and voluntariness of use. (Vankatesh, Davis, Davis and Morris, 2003)

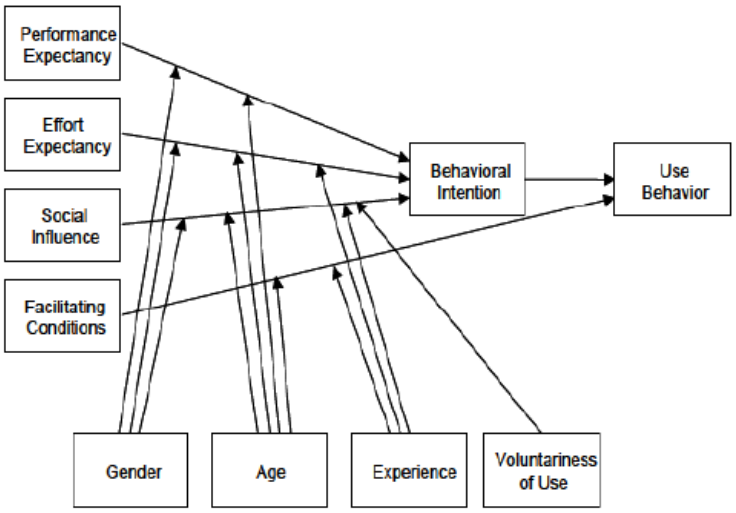

Figure 2.10: Unified theory of acceptance and use of technology (Vankatesh, Davis, Davis and Morris, 2003, p. 447)

2.2.10 Summary of Technology Adoption Models

All technology adoption models are summarized in Table 2.1 on page 20.

Model	**Factors that impact behavior**
Technology Acceptance Model (TAM)	Perceived ease of use Perceived usefulness
Theory of Planned Behavior (TPB)	Attitudes Subjective norm Perceived behavioral control
Combined TAM and TPB (C-TAM-TPB)	Perceived ease of use Perceived usefulness Attitudes Subjective norm Perceived behavioral control
Innovation Diffusion Theory (IDT)	Time Communication channels Innovation Social system
Theory of Reasoned Action (TRA)	Attitude Subjective norm
Social Cognitive Theory (SCT)	Environmental factors Cognitive factors Personal factors
Model of PC Utilization (MPCU)	Long-term consequences Affect toward use Social factors Faciliating conditions
Motivational model (MM)	Intrinsic motivation Extrinsic motivation
Unified theory of acceptance and use of technology (UTAUT)	Performance expectancy Effort expectancy Social Influence Facilitating conditions

Table 2.1: Summary of Technology Adoption Models

2.3 Asymmetric information

Asymmetry is a phenomena which occurs in all types of communication. (Kastberg, 2011) Every individual holds different information and knowledge in different subject areas which creates asymmetry. Age, professions, education level, cultures and nation are also factors which affect asymmetry. (Günthner & Luckmann 2001) There are two aspects of asymmetric information, one is adverse selection, also called “hidden information” (Amit, Brender & Zott, 1998) and the second is moral hazard (Denis, 2004). Akerlof (1970) stated that “hidden information” might impact situations which cause the market to "select" low-quality items due to lack of sufficient information. This give rise to market failure. (Spence, 1973)

These theories have been applied to the financial market and has become more common. (Shah, 2014) Adverse selection could be usable to describe the relationship between the advisor and the customer. (Ottavani, 2000) When there is no incitement for the agent to act in his/her own interest the agent is expected to act in the best possible way for the customers, this leads to a positive reputation for the advisor and hence advantageous customer relationships. Contrary, if incitement is offered to the advisory it is more likely to partial action. (Madhani, 2010) The latter situation causes an imbalance between both parties since the customer believes that the advisor gives trustworthy and correct information to base an investment decision on. Furthermore, the imbalance can cause the consumers insufficient knowledge for personal gains. The moral hazard problem usually occurs in a negotiation situation for instance between a customer and an advisor since the advisor usually has an information advantage. The advisor could use the information advantage and only share some information and hide the rest if it would exist underlying financial incentives. However, the customer benefits from sharing all relevant information since the quality of the investment recommendations should increase. (Ottavani, 2000)

2.4 Literature Review

Robo-advisory is a fairly new innovation and therefore, this area lacks comprehensive research that illustrate the phenomenon from different perspectives. Park, Ryu and Shine (2016) highlight the lack of research within the issue and aims to explain the current status of robo-advisors in United States and describe the realistic and effective feature of robo-advisors. Their study shows that the portfolio management system which robo-advisory is built on still is in the start-up stage and believes that there is a need for further development, but there is also many opportunities. Furthermore, individuals nowadays has a direct or indirect interest in financial investment, but the reasons for their investment decision is based on relatively low knowledge instead of using professional advisors. Park, Ruy and Shine (Ibid) explain that this has resulted in a higher attention for robo-advisory.

One study made by Fisch, Laboure and Turner (2017) with the purpose to compare the quality and cost of advisory concerning investment portfolios provided by robo-advisors versus human advisors. The research determines to what extent robo-advisory is affected by interest of conflicts which is a factor to take in consideration regarding human advisory. The authors argue that robo-advisors are more effective to consider differences within personal risk preferences than human advisors are. Furthermore, the researchers' states that robo-advisors are advantageous since they consider investment horizon and offer a more diversified portfolio than human advisors do. Likewise, the robo-advisory are less likely to be a part of interest of conflict. The probability that a robo-advisor would be affected by biases like demographic or personal integration are also less. Fish, Laboure and Turner (Ibid) consider the best option would be a hybrid between a robo-advisor that collaborates with a human advisor since this would result in lower cost combined with an option to also discuss with a financial advisor.

The phenomena robo-advisor has not only been accepted immediately but has encountered criticism. Some of the criticism is from The Financial Industry Regulatory Authority, FINRA in the USA which 2016 issued a report on robo-advisors entitled "Report on Digital Investment Advice". The report investigates wheather robo-advisory meets the fiduciary stan-

dard of care that applies to broker-dealers and investment advisors under federal securities laws with respect to the investment advice they give individual clients. The report discusses robo-advisors used by individual investors directly and financial professionals used the tool for their clients. In summary, the report emphasizes that, robo-advisors are not a substitute for the suitability analysis required when human advisors provide investment recommendations and are not a substitute for the portfolio analysis required of an investment fiduciary under the fiduciary standard of care. The report states that education and training are necessary for financial professionals before using robo-advisors. Lastly, individual investors should not rely on robo-advisors without assistance of a trained financial professional. (FINRA, 2016)

Another researcher who also highlights a growing awareness for robo-advisory is Fein (2015). Fein (Ibid) states that robo-advisory could be an effective alternative for small investors who are comfortable with making investment decision on digital platforms. The intention of Fein's research is to examine if robo-advisors in fact provide personal investment advice, minimize cost, are free from conflicts of interest and thereby act for the client's best interest. The study is based on a detailed review of user agreements for three financial leading robo-advisors within United States. Fein's findings indicate that robo-advisors did not reach the requirement and do not necessarily provide investment advice which is best for the customer, are not free from conflicts of interest and do not necessarily minimize investment cost. Fein (2015) reports some criticism as well, e.g. robo-advisors should not be characterized as advisors but instead be seen as a digital tool to help the customer to decide one risk and investment preferences. The only reason robo-advisors are called "robo" is due to design and not operate with individual human contact. Furthermore, the customer of robo-advisors should not see it as a correct and extensive phenomena which offer tailored advisory to meet one's financial needs. The criticism against robo-advisory is because it is too simple and not always acts based on the customers' best interest but leaves the responsibility to the customer to act for its own best interest.

There is also lack of previous research about robo-advisory and how this innovation is related to trust due to it being a relatively new innovation. However, there are several researches about internet banking, which robo-advisory can be categorized into due to it being an internet banking service.

One research that investigates the effect of trust on customer acceptance of internet banking shows that trust is one of the most significant factors regarding consumers' adoption of internet banking and attitudes towards using it. Consumers are uncomfortable and concerned with the security when providing sensitive information on the internet and this is a great impediment for consumers trusting internet banking services and the growth of internet banking services. They also connect uncertainty and risk to internet banking services. Besides the risk and concern with leaking sensitive information, uncertainty is perceived due to the parties making the transactions are not in the same place. Consumers do not interact with a human and are not able to observe and depend on the behavior of the other party, such as body signals and physical proximity. Furthermore, consumers rely on trust when using online services that handles sensitive personal information and therefore trust have a great impact on growth and adoption of internet banking services. The study also demonstrates that perceived usefulness and ease of use, which is related to the usability of the technology have are important factors for adopting internet banking. (Suh and Han, 2002)

There are four factors that determine the development of trust for electronic commerce presented by Tan and Theon (2004), which are *understanding*, *personal experience*, *social indicators* and *communality*. Understanding means trusting those capabilities and goals that one understand and can identify with since knowing the expectation of them. Personal experience indicates trusting someone based on previous interactions and positive experiences. Social indicators refers to trusting someone that is certified and is a controlled procedure, such as trust seals on websites. Lastly, communality refers to an individual trusting those who are trusted by other participants of that individual's community. These four factors are also important regarding consumers developing trust for internet banking and other electronic commerce services. (Suh and Han, 2002)

A different study that investigates the adoption of Internet banking combined with unified theory of acceptance and use of technology (UTAUT) and perceived risk to understand and explain the behaviour intention and usage behaviour of Internet banking. The research shows that UTAUT factors such as effort expectancy, performance expectancy and social influence and perceived risk are strong predictors of behavioral intention. The most important factor to explain usage behaviour of Internet banking

is behavioral intention. By adding perceived risk to the UTAUT model the researchers added predictive power of adoption to the current model. (Martins, Oliveira and Popovic, 2014)

Behavioural economics refers to economic decision-making processes of individuals and its effect on markets. The theory explain why and how market may be inefficient. (Sewell, 2007) One study made, with 6 000 individuals in eight EU member states, to analyze the decision-making process of investment. The financial environment has evolved so much that investors usually are not prepared and have limited time to fully make decisions about complex financial products. The main findings was that individuals often were confused about the true nature of their investment and uncertain about the risk following with trade of shares and funds. Furthermore, advice regarding investment where common either face to face or influenced by a professional advisor and professional advice plays a key role in the market. The study also shows high trust in advisors recommendations but the investors are often unaware of potential conflicts of interest, for example that the advisor could be biased. It is also common that people shortcut the process of decision- making by applying heuristics, which is a method used given a limited time frame and is flexible approach when making quick decisions. (Chater, Huck and Indrest, 2010)

2.4.1 Personal traits

There are a lot of previous research on different personal traits and how they impact individuals adoption of technology. The personal traits included here are gender, age, education, income and risk.

2.4.1.1 Gender

There are differences between men and women regarding financial decision making. It has been shown that women are more risk averse than men, not only within financial risk but in everyday life. On average women make safer choices in terms of consumer decision such as seat belt use, dental care and smoking. (Jianakoplos & Bernasek, 1998) The level of

financial knowledge appears to be lower for women in a large number of countries, including Sweden, and could due to gender inequalities in other domains have an effect on financial knowledge. However, younger generation may not face as substantial difference if they have been exposed to a more equal society. (OECD, 2013) Men do not only have higher level of financial knowledge, men also have higher confidence in areas like finance. (OECD, 2013) Thereby men are more overconfident than women and the reason why men invest more than women. (Barber & Odean, 2001) The use of internet banking services are more susceptible to be used by men. Women prefer personal contact while doing errands since they experience it more risky to get information and services direct from the digital media. (Ramón-Jerónimo, Pearl- Pearl & Villarejo-Ramos, 2013)

2.4.1.2 Education

The level of education presumably improves one's financial management and financial participation due to the correlation between education and financial outcomes. The probability of owning equities increases by four percent with one additional year of schooling. Individuals with more years of schooling is more likely to report incomes from both higher wages and retirement saving and are more likely to own equities. (Cole, Paulson & Shastry, 2014). People with higher education level also have higher technology adoption. (Wang, Chen & Chen, 2017) However, a study from USA shows that education level do not affect the adoption to internet banking. (Lassar, Manolis, Lassar, 2005) The most important factors are instead accessibility to internet, awareness about e-banking and the customer's attitude towards changes. (Arenas-Gaitán, Peral-Peral, Angeles Ramón-Jerónimo, 2015).

2.4.1.3 Income

Income is correlated with risk aversion, gender and education. When wealth increase, risk aversion decreases (Jianakoplos & Bernasek, 1998). It is likely that more years of education impact individuals to earn higher wages, thus enabling individuals to invest more and earn additional investment outcome as a result. (Cole, Paulson & Shastry, 2014)

Researchers also investigat consumers adoption of online banking found that income was positively correlated to online banking and the use of the online banking adoption. The users of online banking has been investigated and found that income, education and age are factors that influence the use. Both studies from Finland and Australia show that higher income increases the probability that individuals use online banking and its different services. Another study made in USA shows that the only significant demographic characteristic which affect online banking is income. The same study could not distinguish if education or age had an impact on the use of online banking. Accordingly, the study shows that a higher income leads to a higher use of online banking and also an ability to use it in an early stage. (Lassar, Manolis & Lassar, 2005)

2.4.1.4 Risk

Featherman and Pavlou (2003) defined perceived risk as "the potential for loss in the pursuit of a desired outcome of using e-services" and identifies seven types of risks:

- `Performance risk`: "The possibility of the results not being as they were designed to be and therefore failing to deliver the desired benefits" p. 455.
- `Financial risk`: "The potential monetary loss from the initial purchase of the product and its subsequent maintenance" p. 455 .
- `Time risk`: "When users lose time by making poor purchasing decisions, with researching and making the purchase, and learning how to use it" p. 455.
- `Psychological risk`: "The performance of the product will have a negative effect on the consumers' peace of mind and the potential loss of self-esteem from the frustration of not achieving the buying goal" p. 455.
- `Social risk`: "The potential loss of status in a social group, as a result of adopting a product or service".

- `Privacy risk`: "The potential loss of control over personal information, such as when information about an individual is used without that person's knowledge" p. 455.
- `Overall risk`: "General measure with all criteria together" p. 455.

All these risk types create the perceived risk that the consumer experience and impact the intention of e-service adoption negatively. Lowering consumer's aversion to the risk worries will increase the possibility that the consumer will adopt internet banking. (Bussakorn and Dieter, 2005)

CHAPTER 3

Methodology

The aim of this thesis is to produce new knowledge within the area of robo-advisors and to describe the knowledge in a systematic way. Therefore, it is significant to select a method which enable the research to answer the research questions. It is important to consider and be aware of advantages and disadvantages regarding the method in order to apply the method correctly. This section will present the method approach, the econometric regression models and procedure used in this thesis.

3.1 Research choice

The purpose of this thesis is to examine the consumers adoption of robo-advisory in Sweden and to identify which personal traits and behavioural factors that are important when consumers make the decision to invest via a robo-advisor. To understand a phenomena in context-specific settings a quantitative method is preferably and is defined by Patton (2001) as "real world setting [where] the researcher does not attempt to manipulate the phenomenon of interest" (Patton, 2001, p. 39) by using a quantitative method one seek causal determination, prediction, and generalization of findings. Also, a quantitative method fully describe a phenomenon which is important from the researcher perspective as well as the reader. (Hoepfl, 1997) Jacobsen (2002) explains that an advantage of implementing a quantitative survey is that one can examine many different unit to a low cost. Quantitative methods focus on the collection and the analysis of the data since the method aim to collect large amount of data

which can be gathered by surveys or interviews.(Bryman & Bell, 2003) For this thesis a quantitative method was used since there was limited previous research within the area of robo-advisory. Furthermore, the aim is to investigate customer characteristics and their opinion, attitudes and thoughts regarding robo-advisors and a quantitative study is therefore the best alternative.

3.2 Data collection and description

The data has been collected through a survey during two weeks of spring 2018 and is classified as cross-sectional data. It includes measurements for individual observations at a given point of time and timing difference can usually be ignored with cross-sectional data. (Carter- Hill, Griffiths & Lim 2011) Due to lack of previous research within the area and this thesis having specialized research questions within the Swedish financial market, second hand data could not be used. Therefore, primary hand data was collected to answer the research questions. Primary data has advantages in being relevant for this specific study and will be up to date. Primary data has higher credibility and the quality is easier to ensure since it has not been collected by an external part. However, primary data can be problematic due to cost, time of confidential aspects. (Bryman & Bell, 2003)

Surveys can reach many respondents at the same time, unlike a qualitative method. The standardization of the questions implies that there is no difference in formulation which may be the case in qualitative interviews. The respondents can choose when and if they have time to answer the survey questions. Contrariwise, one have to be aware of the challenges with surveys. Since there is no further questions due to a specific question it can result in missing important information. Another challenge is the design of the survey, it cannot include unrelated questions since it could affect the answer rate of the respondents. (Bryman & Bell, 2003) To avoid that challenge a small sample group has tested the survey before publishing and contributed with their opinions and thoughts. This was important in order to ensure the quality of the survey and test if they understood the questions since the survey cannot be update when it has been published. The survey questions are based on the respondents'

perception, opinion and attitudes towards robo-advisory, which makes the answers subjective.

The link to the survey was published on LinkedIn, Twitter, Facebook and on the intranet at a Swedish bank. Due to confidentiality, the chosen bank will be anonymous. Social medias applies algorithms regarding who will see the survey. It starts small within the network and then the survey will be spread by the network. The link was active for two weeks and during that period 435 people answered the survey. The survey did not have a specific target group and the same link was published on all platforms. However, most of them were 18-35 years of age within our network and have connections to the finance and bank sector or are students within the economic area. Both of the writers of this thesis work within the financial market and one can assume that their network also have a connection to the financial industry. Therefore, it is likely to believe that this sample contains mostly working professionals within finance. All those factors could cause bias data. However, spreading the survey through respondents that have previous knowledge within financial market or within robo-advisory, could in this case be an advantage. Since robo-advisory is a novel innovation it may need to be adopted by people within these segments first before spreading the innovation to mainstream consumers. Having a valuable innovation entails spreading of that innovation and it will probably be done by members within these segments in an early stage. One probably will be more likely to trust and adopt the innovation if it is used by people within the financial market.

3.2.1 Survey description

An electronic survey was created to collect the data for this research through the website Survey Monkey (www.surveymonkey.se). It consisted of 28 questions about individuals' investment habits and attitude towards robo-advisory and human advisory. The survey begin with questions about personal traits followed by questions that leads to three different paths; people who have not invested in securities, people who have invested in securities but never via a robo-advisor and people who have invested in securities and via a robo-advisor. The majority of the questions were highly structured, in a form of multiple-choice, together with some

open-ended questions, making it possible for the respondents to provide answers of their own. The open-end questions could help to collect necessary data that the survey may have missed to include. There were two questions which were not highly structured into multiple-choice. In the first question, the respondents provided their answers in a matrix regarding cost, usability, revenue and user experience, where they were asked to compare robo-advisory with human advisory. The other question was regarding how robo-advisory could be improved, and in this question the respondents could choose the alternatives which they though best fitted their opinion, including choosing more alternative than one. The purpose of not having these question as multiple-choice was to see what the respondents thought was important in order to be able to adopt the robo-advisory which could include more alternatives than just multiple-choice. Worth to notice, the people who answered the survey did not answer all 28 questions, the respondents were directed to different questions depending on their answer in previous question. This was made to distinguish different personal traits and earlier experience in order to analyze the differences regarding robo-advisory between the groups. Furthermore, anonymity has been guaranteed for all respondents in order to make sure that the respondent could answer completely truthfully to the questions. For an overview of the survey, see Appendix A. In Appendix A, the questions and the alternatives the respondents could choose on each questions are included.

We also provided the respondent a definition for robo-advisory and human advisory. The definitions are:

- Robo-advisory is personal advice about financial instruments (i.e. securities such as shares and funds) that is given without human involvement or with limited human involvement, usually online.
- Human advisory is personal advice about financial instruments (i.e. securities such as shares and funds) that is given with human involvement, via dialogue with a person who works with financial advisory.

3.2.2 Variables and Hypotheses

This research include two dependent variables and eleven independent variables. Our two dependent variables are; if one has ever invested in securities and if one ever have invested in robo-advisory. Two dependent variables are chosen because the aim is to research the consumers adoption of robo-advisory as well as investigate consumers personal traits and behavioural factor that impact the investment decision. By choosing two dependent variables we can investigate both the consumers who are investigating through robo-advisory today and potential consumers.

The control variables will be used as independent variables within the regressions. The purpose of using independent variables are to investigate whether different factors have significant influence on the dependent variables. Due to previous research within personal traits and behavioural theories we can conclude that all independent variables may have an impact on our dependent variables. However, all of the eleven independent variables will not be included in both models. The regression having securities as dependent variable will only include the six personal traits variables. This since the rest of the variables are connected to robo-advisory and will have no connection to if one invest in securities or not. The regression with robo-advisory as the dependent variable will include all eleven independent variables since all of these variables are interesting to include due to previous research regarding personal traits and behavioural theories about perceived attitudes and expectations. A description of the two dependent variables are presented in table 3.1 and the eleven independent variables including hypotheses based on previous research are presented in table 3.2 on page 34.

Variable	**Description**
Securities	Previous experience of investing in any type of security
Robo-advisory	Previous experience of investing via a robo-advisor

Table 3.1: Dependent Variables described

Variable	Description	Hypotheses
Gender	Gender of the respondents	Males are more likely to invest in securities and robo-advisory than women
Age	Age range of the respondents	Younger people are more likely to invest robo-advisory but older people are more likely to invest in securities
Education	Level of education based on degree	Those with higher education will probably be more likely to invest in securities and robo-advisory
Income	Income range of the respondents	Those with higher income will probably be more likely to invest in securities and robo-advisory
Montly Savings	Savings per month in SEK	Those with higher monthly savings will probably be more likely to invest in securities and robo-advisory
Risk_ps	Personal risk level based on different quotes	Males are more likely to take risk when investing in securities and robo-advisory than women
Risk_hr	Perceived risk regarding robo-advisory compared to human advisory	The higher perceived risk of robo-advisory, the more likely the individual will prefer human advisory
Return	Perceived return regarding robo-advisory compared to human advisory	The higher perceived return of robo-advisory, the more likely the individual will prefer robo- advisory
Cost	Perceived cost regarding robo-advisory compared to human advisory	The higher perceived cost of robo-advisory, the more likely the individual will prefer human advisory
Usability	Perceived usability regarding robo-advisory compared to human advisory	The higher perceived usability of robo-advisory, the more likely the individual will prefer robo- advisory
Trust	Perceived trust regarding robo-advisory compared to human advisory	The higher perceived trust of robo-advisory, the more likely the individual will prefer robo- advisory

Table 3.2: Independent Variables described

3.2.3 Descriptive statistics

Table 3.3 presents descriptive statistics for the 435 respondents who answered the survey. The observation differs for the variables because no question in this survey were mandatory and respondents may have skipped one or more questions or did not receive the question because the order of the questions was determined by previous answers.

Variable	**N**	**Subcategories**	**Respondents in %**
Securities	433	Yes	90
		No	10
Robo-advisory	388	Yes	13
		No	87
Gender	435	Male	61
		Female	39
Age	435	Under 18	0
		18 - 35	73
		36 - 50	20
		Over 50	7
Education	433	Elementary school	0,5
		High School	22
		Vocational education	2
		Bachelor's Degree	40
		Master's Degree	35
		Doctor of Philosophy	0,5
Income	432	0 - 20 000	27
		20 001 - 30 000	13
		30 001 - 40 000	31
		40 001 - 50 000	14
		Over 50 000	16
Monthly Savings	434	0	7
		Less than 100	1
		100 - 300	2
		301 - 500	4
		501 - 1 000	12
		1 000 - 5 000	42
		More than 5 000	33
Risk_ps	434	I don't want to take any risk at all	1
		I want to take minimal risk	9
		Some risk is ok	37
		I want to take risk	37
		I want to take high risk	16
Risk_hr	393	Higher	9
		No difference	34
		Lower	32
		I don't know	25
Return	392	Higher	14
		No difference	35
		Lower	21
		I don't know	30
Cost	365	Higher	24
		No difference	9
		Lower	49
		I don't know	18
Usability	394	Higher	43
		No difference	16
		Lower	17
		I don't know	25
Trust	391	Robo-advisor	23
		Human advisor	49
		I don't know	37

Table 3.3: Descriptive statistics for all dependent and independent variables

433 respondents answered the question whether they have invested in securities or not. The data shows that 90% which is the majority of the respondents that had invest or currently invest in securities.

388 respondents answered the question whether they had invest in robo-advisory or not. The data indicates that most respondents have not invested in robo-advisory.

Of 435 respondents most of them were men between the ages 18-35. Most of our respondents have a bachelor's degree, has an income between 30 001 - 40 000 SEK and the data of monthly saving indicates that the most common monthly savings is 1 001 - 5 000 SEK. Most of our respondents thinks that some risk is ok and also want to take risk.

For the question where the respondents compared perceived risk, return, cost and usability regarding robo-advisory with human advisory most respondents answered that they perceived that there is no difference in risk between a robo-advisor and human advisor. They also answered that they perceived return and cost regarding robo-advisory was respectively no difference and lower compared to human advisory. Concerning usability, most respondents answered that they perceived higher usability when comparing robo-advisory with human advisory.

Lastly, the majority of the responses answered that they trust recommendation from a human advisory more than from a robo-advisor. Furthermore, 37% do not know whether they trust recommendations from a human advisor or robo-advisor more.

3.2.3.1 Modified Data

When analyzing the data, we observed that several answer alternatives gave very few answers. Therefore, we merged those alternatives that had few answers to reduce outliers and skeweness (Carter- Hill, Griffiths & Lim 2011). We also dropped the alternative *under 18* due to no respondents choosing this alternative. Variables and answer alternatives that were modified are presented in table 3.4. Commented alternatives in the table are the ones that have been modified and remaining alternatives stayed

the same. Regarding the variables risk_hr, return, cost and usability, we merged the alternatives *no difference* and *i don't know* due to the meaning of these two alternatives being similar.

Variable	**Alternatives**	**Modified Alternatives**
Age	Under 18 (dropped) 18 - 35 36 - 50 (merged) Over 50 (merged)	18 - 35 Over 36
Education	Elementary School (merged) High School (merged) Vocational education (merged) Bachelor's degree (merged) Master's degree (merged) Doctor of Philosophy (merged)	Bachelor's degree and under Master's degree and above
Monthly savings	0 (merged) Less than 100 (merged) 100 - 300 (merged) 301 - 500 (merged) 501 - 1 000 1 001 - 5 000 More than 5 000	Less than 501 501 - 1 000 1 001 - 5 000 More than 5 000
Risk_ps	I want to take high risk (merged) I want to take risk (merged) Some risk is ok I want to take minimal risk (merged) I do not want to take any risk at all (merged)	Risk lover Some risk is ok Risk averse
Risk_hr	Higher No difference (merged) Lower I don't know (merged)	Higher Indifferent Lower
Return	Higher No difference (merged) Lower I don't know (merged)	Higher Indifferent Lower
Cost	Higher No difference (merged) Lower I don't know (merged)	Higher Indifferent Lower
Usability	Higher No difference (merged) Lower I don't know (merged)	Higher Indifferent Lower

Table 3.4: Modified data

3.2.3.2 Comparative Data-sets

To see whether the data-set is representative some variables will be compared with statistics from Statistics Sweden (SCB).

435 people answered our survey, however Sweden has approximately 10 million inhabitants today (SCB, 2017) and one can tell this data-set may not be representative for Sweden.

Out of approximately 10 million inhabitants, approximately 50% are men and 50% are women (SCB, 2017). The data-set shows that 61% men answered the survey, 38% were women and 1% answered other and thereby did not identified themselves neither as a man or a woman. This indicates that slightly more men answered the survey compared to the Swedish inhabitants.

The average Swedish person is approximately 40 years old (SCB, 2017). The survey had extensive age ranges and almost 73% answered they were in the age between 18-35. Approximately 20% were between age 36-50 and 7% over 50 years old. Thereby, this data-set has younger respondents than the age of the average Swede. However, as told above, this is not necessary an disadvantage since the adoption should be better among this segment.

According to SCB (2017) the most common education level is a post-secondary, 3 years or more. In this data-set a bachelor degree, a master degree and a Doctor of Philosophy will be included in the post-secondary data. 76% of the respondents holds a bachelor degree or a higher degree.

The average monthly income in Sweden is 32 800 SEK (SCB, 2017). Around 31% of the respondents has an income between 0 - 20 000 probably most of these are students. 13% have an income between 20 001- 30 001, 27% earns between 30 000 - 40 001, 14% have an income between 40 001 - 50 000 and lastly 16% have an income over 50 000 SEK. This indicates that the most of the respondents are in the same range where the average Swedish income are.

Under 2017 the Swedish households net saving ratios was almost 16%

(SCB, 2017). This implies that with an average income of 32 800, the Swedish household saved around 5 200 SEK. 42% saves between 1 001 - 5 000 and 33% saves more than 5 001 SEK. The reason why this sample shows that the majority of the respondents save less than the average Swede could be explained by the students who answered the question, which has limited income and hence, save less.

According to a report from SCB (2017), around 14% of the Swedish citizens owns shares on a Swedish market. 11% are women and 16% are men. (SCB,2017) In the data-set 90% answered that they have invested in securities, which includes shares, funds, ETF:s, Certificate and Obligations. The data-set has a much higher number of respondents which has answered that they invest in securities since the survey was published on a Swedish bank and also our network consists of mostly people who work in the financial industry.

3.2.4 Econometric model

This section presents the econometric model that is chosen for this thesis.

3.2.4.1 The probability model

This thesis will have two dependent variables due to the research question, however both dependent variables are binary which implies a value of either *one* or *zero*. *One* implies that a person has invested in securities and robo-advisory and *zero* if a person has not invested in securities and robo-advisory. Due to binary dependent variables two probability (probit) models were used as econometric method which compute non-linearly related probabilities between the dependent variables and the independent variables. These models compute the probability if a person has invested in securities and robo-advisory or not and explains an individual's choice. The probit models does not assume that the marginal effects are constant which is seen as an advantage. It is mainly assumed that the marginal effects are declining when X_i is increasing and therefore, these models should be more suitable than an linear probability model. The probit model assume homoscedasticity, therefore heteroscedastic can be

disregarded. (Carter- Hill, Griffiths & Lim 2011)

The probability p_i of an event occurring is determined by the function $F(Z_i)$, where $F(Z_i)$ is the cumulative standardized normal distribution as seen in function 1:

$$p_i = F(Z_i) \tag{1}$$

Due to having two dependent variables, securities and robo-advisory, two probit models are created. The probability of an individual investing in securities is expressed by function 2:

$$p_i = p(securities = 1) = F(Z_i) \tag{2}$$

Z_i is estimated by function 3 for the securities probit model:

$$\begin{aligned} Z_i = \beta_1 gender_i + \beta_2 age_i + \beta_3 education_i + \beta_3 income_i \\ + \beta_4 monthlysavings_i + \beta_5 risk\_pr_i \end{aligned} \tag{3}$$

The probability of an individual investing via a robo-advisor is expressed by the probit function 4:

$$p_i = p(robo - advisory = 1) = F(Z_i) \tag{4}$$

Z_i is estimated by function 5 for the robo-advisory probit model:

$$\begin{aligned} Z_i = \beta_1 gender_i + \beta_2 age_i + \beta_3 education_i + \beta_3 income_i \\ + \beta_4 monthlysavings_i + \beta_5 risk\_pr_i + \beta_6 risk\_hr_i \\ + \beta_7 return_i + \beta_8 cost_i + \beta_9 usability_i + \beta_{10} trust_i \end{aligned} \tag{5}$$

Since the probit model is non-linear, i.e. derived from the standard normal distribution, it is important to be aware of that the coefficients cannot be interpreted due to partial-slope coefficients. Therefore, it is needed to estimate the marginal effects. The marginal effect is only an estimation and not perfectly precise since the marginal effect changes continuously along the estimated function. When taking the derivative of the probit function with respect to X_i, the explanatory variable, the marginal effect is calculated and expressed by function 6:

$$\frac{\partial p}{\partial X_i} = \frac{\partial p}{\partial Z}\frac{\partial Z}{\partial X_i} = f(X)\beta_i \tag{6}$$

Lastly, to calculate the marginal effect it is multiplied with the estimated coefficient β_i, which results in function 7 (Carter- Hill, Griffiths & Lim 2011):

$$f(Z) = \frac{1}{\sqrt{2\pi}}e^{-\frac{1}{2}Z^2} \tag{7}$$

The probit model generates a coefficient of determination for measurement of goodness-of-fit, Pseudo R^2. This explains how well the model fits the set of observations, but is not calculated in the same way as OLS R^2. However, they have similarities regarding the scale, ranging from 0 to 1. Higher values indicated a better model of fit. There are different types of pseudo R^2 measurements that can be calculated in STATA after running a probit model; McFadden's R^2, McKelvey and Zovoina's R^2, Cragg & Uhler's R^2 and Effron's R^2.(Carter- Hill, Griffiths & Lim 2011) For our probit models McFadden's was chosen and having a pseudo R^2 coefficient between 0.2 - 0.4 indicates a good fit of the model. (McFadden, 1979)

The independent variables are categorical variables, but they need to be in a interval scale in order to make a regression. Hence, we created dummies for these variables. By doing so the variables can be considered as interval scale since they only have two possible values, *zero* and *one*. (Carter- Hill, Griffiths & Lim 2011)

3.2.5 Multicollinearity

It is important to be aware of common econometric problems associated with the method when conducting a quantitative research. Consequently, potential econometric problems need to be handled with transparency. If two or more of the explaining variables in the regression are highly correlated, the model can suffer from multicollinearity. The explaining variables are highly correlated if the correlation takes a value of 0.8 or more (Westerlund, 2005). Multicollinearity causes an increase in the variance of the variables and in turn reduces the explanatory capabilities of the model. If multicollinearity is sufficiently large, it could cause problem with the estimation and therefore result in an unreliable model. (Dougherty, 2011). To detect multicollinearity within the probit model a correlation matrix was used to check for high correlation between our explanatory variables. A value higher than 0.8 indicates high correlation between variables which could lead to multicollinearity. Therefore, variables with a higher value than 0,8 should be excluded from the model. The two correlation matrices did not show a higher value than 0.8 and therefore no variables was excluded. Due to the probit model, there is no further test available to check for multicollinearity, as for example a VIF test for OLS (Dougherty, 2011).

3.2.5.1 Correlation matrix for securities

	securities	gender	age	education	income	monthly savings	risk_ps
securities	1.0000						
gender	-0.2580	1.0000					
age	0.1189	0.0464	1.0000				
education	0.0888	0.0278	-0.0864	1.0000			
income	0.2111	-0.2116	0.4591	0.2057	1.0000		
monthly savings	0.2098	-0.1175	0.1152	0.0832	0.3639	1.0000	
risk_ps	-0.1231	0.2855	0.1033	-0.0922	-0.1852	-0.0892	1.0000

Table 3.5: Correlation matrix for securities regression

Table 3.5 shows the correlations between our variables. The highest correlation coefficient is 0.4591 between age and income for the securities model. This value are lower than 0.8 which indicates that there is no sign of multicollinearity within this model and all chosen variables can be included in the regression model.

3.2.5.2 Correlation matrix for robo-advisory

	robo advisory	gender	age	education	income	monthly savings	risk_ps	risk_hr	return	cost	usability	trust
robo advisory	1.0000											
gender	0.0913	1.0000										
age	0.0299	0.0976	1.0000									
education	0.0186	0.0587	-0.1127	1.0000								
income	0.0298	-0.1333	0.44312	0.1656	1.0000							
monthly savings	0.0479	-0.0503	0.0860	0.0340	0.3280	1.0000						
risk_ps	0.0362	0.2572	0.0936	-0.0757	-0.1841	-0.0598	1.0000					
risk_hr	-0.0045	0.0242	0.0393	-0.1181	-0.1111	-0.0305	0.1158	1.0000				
return	-0.0413	0.0891	0.0130	-0.0650	-0.1213	-0.0350	0.1185	0.4968	1.0000			
cost	-0.0971	0.1557	0.1566	-0.0532	-0.0284	0.0125	0.1615	0.2664	0.2587	1.0000		
usability	-01465	0.1296	-0.0610	-0.0384	-0.1823	-0.0414	0.1382	0.2789	0.3299	0.3003	1.0000	
trust	0.0384	0.0196	-0.0538	0.0381	0.0419	-0.0124	0.0260	-0.0248	0.1038	0.0620	0.0639	1.0000

Table 3.6: Correlation matrix for robo-advisory regression

Table 3.6 shows the correlations between our variables. The highest correlation coefficient is 0.4968 between return and risk_hr for the robo-advisory model. This value are lower than 0.8 which indicates that there is no sign of multicollinearity within this model and all chosen variables can be included in the regression model.

CHAPTER 4

Empirical analysis

This chapter first present the results from the the survey followed by the results from the two probit regressions. It also includes analyzes of the results.

4.1 Results

4.1.1 Survey statistics

Questions that was not included in the regressions will be presented in this section. In some questions the respondents could choose the alternative "other" and by themselves describe if they believed that their answer was missing as an answer alternative. The "other" alternative was included in the question in order to know if the question was missing some important information. However, there was no specific pattern in the answers so the "other" alternative will not be presented. Each question is presented under the graph that shows the result for that particularly question. Worth noticing are that in some questions, the respondents could choose more than one answer alternative in order to better collect their opinions. All the percentage numbers are rounded to the nearest integer.

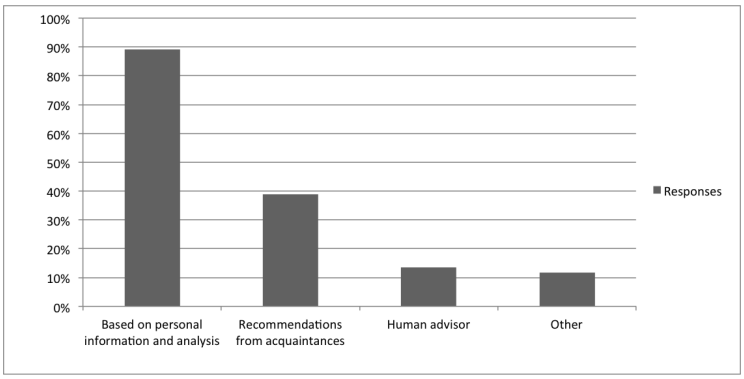

Figure 4.1: Response results for survey question 11, *"How do you invest?"*

In question 11 the respondents were able to choose more than one answer and the question was directed towards those who have invested or invest in securities.

Figure 4.1 shows that 89% report that they do investment based on personal information and analysis. Of those who chose this alternative, 90% of all men invest based on personal information and analysis whereas 61% of all women invest based on personal information and analysis.

Furthermore, 39% also invest based on recommendations from acquaintances, where 6% percent of the women and 2% of the men invest based on recommendations.

13% of the respondents do also invest through a human advisor. Men who invest via a human advisor equals to eight percent and women who invest via a human advisor equals to 31%.

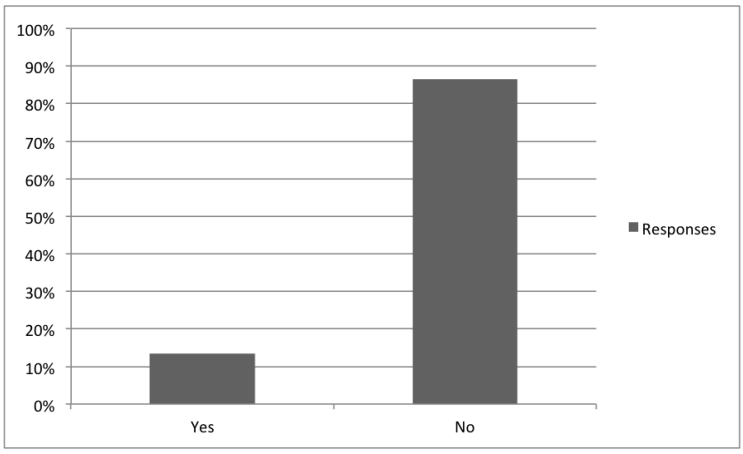

Figure 4.2: Response results for survey question 12, *"Do you currently invest, or have you invested, via robo-advisory (digital automated advisory)?"*

Figure 4.2 shows that 13% answered that they currently invest or have invested via robo-advisory, which equals to 52 individuals. 87% have not invested through robo-advisory. 13% of all male respondents invest or have invest via robo-advisory and 10% of all female respondents invest or have invested via robo-advisory. Of those 52 persons that invest or have invested in robo-advisory 50% have an income that can be classified as high (over 40 000 SEK per month). Furthermore, the majority of these have a high education level.

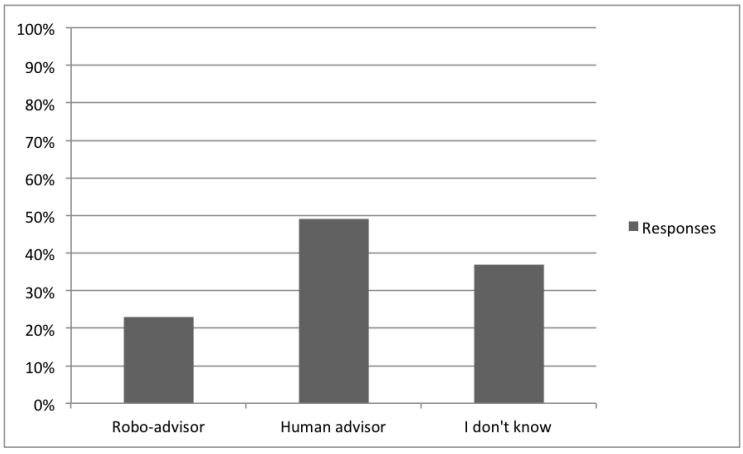

Figure 4.3: Response results for survey question 16 and 23, *"Whose recommendation do you trust more?"*

Figure 4.3 presents that 43% of all respondents would trust financial recommendation from a human advisor more than a robo-advisor. Individuals who would trust financial recommendation from a robo-advisor

more added up to 19% and 37% do not know whether they would trust financial recommendations from a robo-advisor or human advisor more.

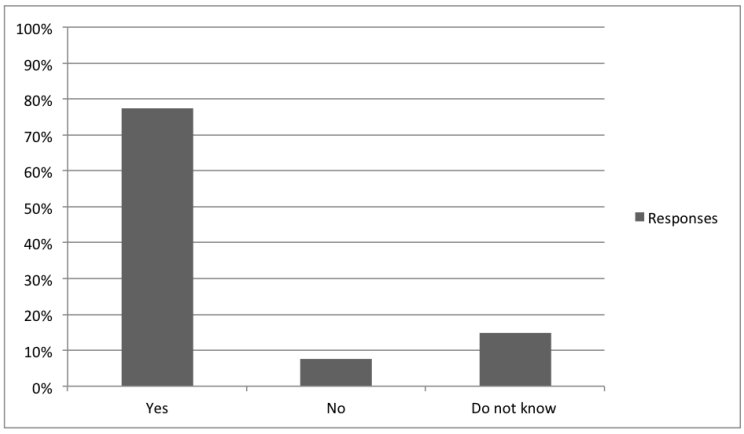

Figure 4.4: Response results for question 17, *"Do you think that robo-advisory will be a successful investment alternative in the future?"*

Figure 4.4 shows that 77% of the respondents believe that robo-advisory will be a successful investment alternative in the future and 8% do not think so. At the same time, 15% of the respondent do not know whether robo-advisory will be successful or not.

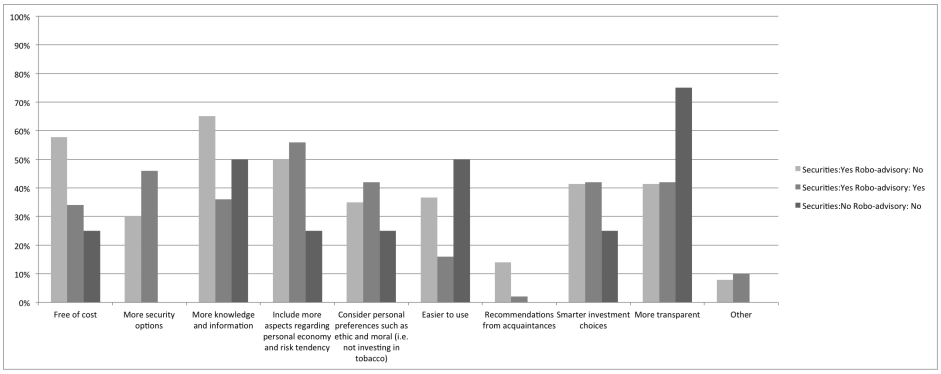

Figure 4.5: Response results for survey questions 18, 24 and 28, *"Which factors needs to be improved within robo-advisory?"*

Figure 4.5 presents results from three survey questions; 18, 24 and 28. All three questions have the same purpose and answer alternatives. The reason behind the existence of three equal questions is that the respondents received questions based on their answer to the previous question and there are three different paths that could be taken throughout the survey:

- Respondents who have invested in securities, but not via robo-advisory (light grey)
- Respondents who have invested in securities and via robo-advisory (medium grey)
- Respondents who have not invested in securities and not via robo-advisory (dark grey)

All of them received the same question at the end of the survey. The graph shows several remarkable findings. The majority of individuals who chose that a robo-advisor should be free of cost, which equals to 58% is individuals who have invested in securities but never via a robo-advisor. The majority of respondents who chose the alternative that robo-advisors should be more transparent equal to 75 % is people who have never invested in securities and never via a robo-advisor. 65% of the respondents who have invested in securities but never via a robo-advisor need more knowledge and information about robo-advisory, which are the majority of the respondents who chose that alternative. Individuals that have never invested in securities and not via a robo-advisor did not choose the options *"more security option"* and *"recommendation from acquaintances"*.

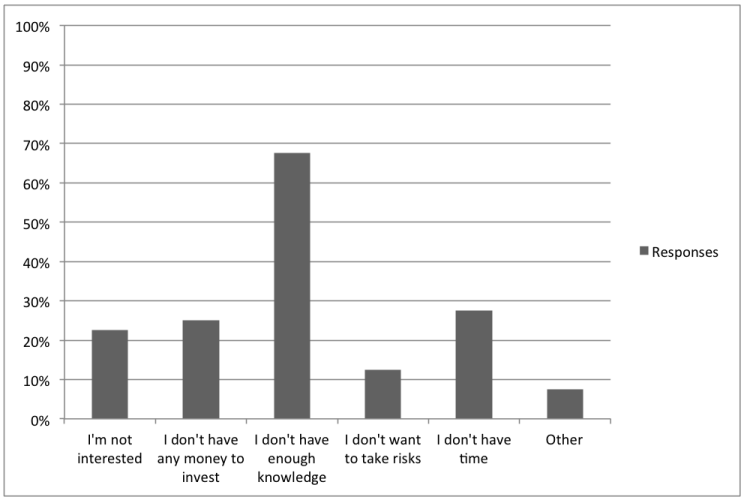

Figure 4.6: Response results for survey question 25, *"Why do you not invest today?"*

Figure 4.6 presents a question that is aimed for those who answered that they have not invested in securities at all and they were able to

choose more than one alternative. With 68%, the biggest reason why the respondents did not invest in securities was due to they believing that they did not have enough knowledge. 23% of the respondents also answered that they were not interested, 25% also believed that they did not have any money to invest. 13% did not want to take any risk and 28% did not have time to invest.

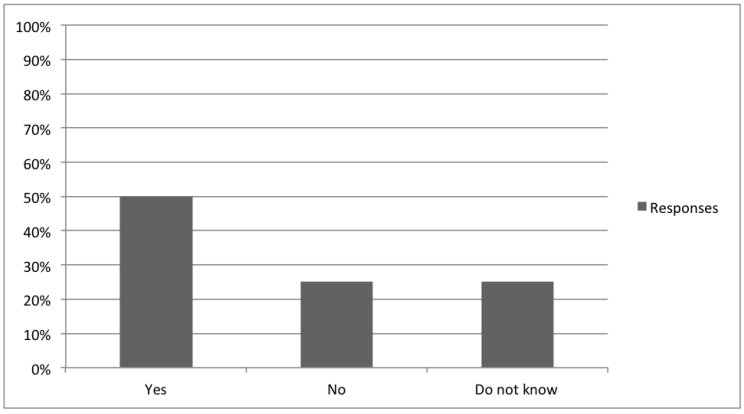

Figure 4.7: Response results for survey question 26, *"Would you, for a fee, consider to invest in securities if you got help from a human advisor or robo-advisor?"*

Figure 4.7 present data for individuals who have not invested in securities before, but would for a fee, consider to invest in securities if they received help from either human advisory or robo-advisory. 50% would invest if they got help. 25% would not invest even if they got any help and 25% do not know if they want to invest even if they got help to invest.

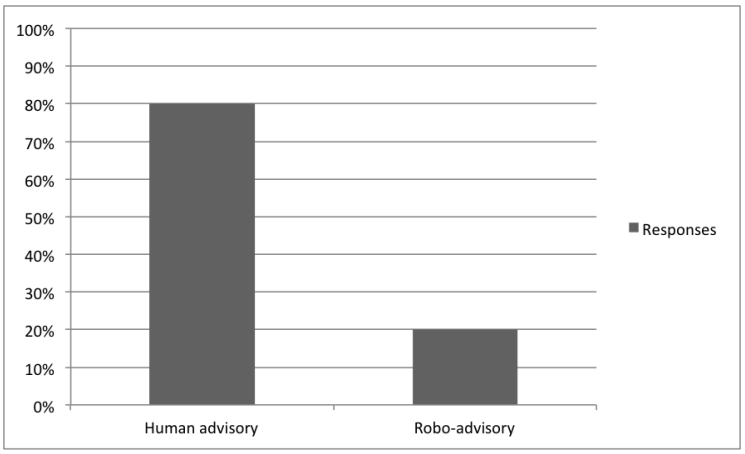

Figure 4.8: Response results for survey question 27, *"Would you prefer human advisory or robo-advisory?"*

Figure 4.8 shows if those who have never invested in securities before would prefer human advisory or robo-advisory. The majority, 80%, would prefer a human advisory instead of a robo-advisory and 20% would prefer robo-advisory instead of human advisory.

4.1.2 Probit model and average marginal effect - securities

Table 4.1 on page 51 describes the results from the probit model including average marginal effects. It shows the independent variables effect on securities and how significant the results are. Comments will only be made on those variables that are statistically significant.

The statistical significance of the variable coefficients are measured through the z-statistic values. Coefficient z-values that are lower than the three significance levels are marked with stars. The number of stars for each level are presented in the Table 4.1.

The results for the probit regression shows that being a female decreases the likelihood to invest in securities with 17% on a 1% significance level. Having a bachelor degree will decrease the likelihood of investing in securities but due to no significant marginal effect we can not define with how much the probability decreases.

Probit Securities	**Coefficient**	**Standard error**	**Z-statistics**	**Average Marginal Effect, dy/dx**
Gender				
Male	(ref.)			
Female	-.7264476	.234721	-3.78**	-.1738569**
Age				
18 - 35	-.1942266	.4483829	-0.55	-.6593561
Over 35	(ref.)			
Education				
Bachelor's degree and under	-.4367187	.28494	-2.06*	-.4140512
Master's degree and above	(ref.)			
Income				
0 - 20 000	(ref.)			
20 001 - 30 000	.5283751	.7438165	1.61	.0789499
30 001 - 40 000	.3515165	.2924575	1.20	.0573525
40 001 - 50 000	.7387529	.5062191	1.46	.099141
Over 50 000	.1508017	.4385786	0.34	.02708
Monthly savings				
Less than 501	(ref.)			
501 - 1 000	.4070878	.96906	1.46	.2347893
1 001 - 5 000	.5551901	.3684597	2.55*	.1790303*
More than 5 000	.6734675	.408065	1.97*	.2074155
Risk_ps				
Risk lover				
Some risk is okay	-.3508670	.2225674	-1.67	-.8934373
Risk averse	(ref.)			
McFadden's Pseudo R2	0.2534			
N	387			387
Statistical significance levels	***z<0.05 **z<0.01 ***z<0.001**			

Table 4.1: Probit regression with securities as the dependent variable.

The likelihood of investing in securities increases with approximately 18% if the respondents saves 1 001 - 5 000 SEK per month. Moreover, having monthly savings over 5 000 SEK each month also increases the likelihood investing in securities but due to no significant marginal effect we can not define with how much the probability increases. Both results are significant on a 5% significance level.

The McFadden's Pseudo R2, which measures goodness of fit, is 0.2534. This indicates that our model have a good fit due to the coefficient being in the range of 0.2 - 0.4.

4.1.3 Probit model and average marginal effect - robo-advisory

Table 4.2 on page 53 describes the result from the probit model, including average marginal effect. It shows the independent variables effect on robo-advisory and how significant the results are. Comments will only be made on those variables that are statistically significant.

Being a female increases the likelihood of using robo-advisors with approximately 22% and have a significant level of 1%.

Respondents that identify themselves as risk averse increase the likelihood of using robo-advisory with 14.6% on a 1% significance level. Of those respondents, 2% are men who chose that alternative and 20% are women.

The likelihood of using robo-advisory decreases for respondents who perceived that the risk is higher for robo-advisory than human advisory on a 5% significance level. Due to no significant marginal effect we can not define with how much the probability decreases.

The likelihood of using robo-advisory decreases for respondents who perceived that the usability of robo-advisory is lower compared to human advisory with 13.5% on a 5% significance level.

The likelihood of using robo-advisors decrease for respondents who answered that they trust a human advisors more than a robo-advisors with

Probit Robo-advisory	**Coefficient**	**Standard error**	**Z-statistics**	**Average Marginal Effect, dy/dx**
Gender				
Male	(ref.)			
Female	1.812352	.7998435	2.79**	.2189765**
Age				
18 - 35	.7879025	1.145278	0.37	.04159320
Over 35	(ref.)			
Education				
Bachelor's degree and under	-.8962094	.498979	-1.41	-.03390517
Master's degree and above	(ref.)			
Income				
0 - 20 000	(ref.)			
20 001 - 30 000	-.6784356	.856709	-0.76	-.0492815
30 001 - 40 000	.4578167	.876389	0.70	.05643890
40 001 - 50 000	.412238	.795864	0.46	.0297856
Over 50 000	-.346082	1.254156	-0.28	-.0322376
Monthly savings				
Less than 501	(ref.)			
501 - 1 000	.230985	.8951018	0.23	.2367109
1 001 - 5 000	-.1689756	.9814321	-0.21	.0026812
More than 5 000	-.4368971	.5709821	-0.38	.6071994
Risk_ps				
Risk lover	(ref.)			
Some risk is okay	.9081289	.9659755	0.94	
Risk averse	2.031014	.9993013	2.03**	.146058**
Risk_hr				
Higher	-1.575014	.7275029	-2.16*	.3371964
Indifferent	(ref.)			
Lower	1.769087	.4689009	.89	.4582106
Return				
Higher	1.254723	.905256	1.23	.5592158
Indifferent	(ref.)			
Lower	1.762258	1.374088	1.28	.1187307
Cost				
Higher	1.659045	.8790122	1.30	-.231750
Indifferent	(ref.)			
Lower	-1.0047238	.8885623	-1.18	-.0991071
Usability				
Higher	1.076545	.6142914	0.64	.1853011
Indifferent	(ref.)			
Lower	-1.773188	1.22569	-1.45*	-.135967*
Trust				
Robo-advisor	.432951	.9856306	1.49	.2361947
Human advisor	-2.309716	.9190419	-2.51*	-.210357*
Do not know	(ref.)			
McFadden's Pseudo R2	0.3876			
N	322			322
Statistical significance levels	***z<0.05 **z<0.01 ***z<0.001**			

Table 4.2: Probit regression with robo-advisory as the dependent variable

21% on a 5% significance level.

The McFadden's Pseudo R2, which measures goodness of fit, is 0.3876. This indicates that our model have a good fit due to the coefficient being in the range of 0.2 - 0.4.

4.2 Analysis of the survey questions

4.2.1 Innovation Adoption

Individuals adopting an innovation or technology before everyone else are innovators and early adopters who are interested in technology. These people also tend to have higher education and higher financial status. (Moore, 1991) Since robo-advisory has been categorized as an innovation, due to being one of five types of innovations according to Schumpeter (1939), which is "launching a new product or a new quality of a product". The 13% of the respondents who responded that they currently invest or have invested in robo-advisory can be categorized as innovators and early adopters. In line with the theory the majority of the respondents classified as early adopters has a high education level. However, 50% of the respondents could be categorized as having a higher financial status than the average Swedish person.

4.2.2 Disruptive Technology

The result of 13% who have used robo-advisory and 87% who have never used robo-advisory may also be connected to Christensen's (1997) description of disruptive technologies, which indicates that a new disruptive technology will under-perform and be rejected by incumbents initially and therefore the innovation will not be widely adopted by consumers. However, the innovation will be improved over time and replace older technologies. In this phase the innovation will be adopted by mainstream consumers in the market. This can also be correlated to our results, which present that half of the respondents who do not invest today would, for a fee, consider investing if they received help. Of those individuals, 80%

answered that they would prefer help from a human advisor and 20% answered that they would prefer help from a robo-advisor.

4.2.3 Technology Acceptance and Trust

Robo-advisors will probably be more common to use in the future. 77% of the respondents believe it will be a successful investment alternative later on. The innovation robo-advisory can be a disruptive innovation since it includes the evolution of a product or service over time. (Christensen, Raynor & McDonald, 2015) This may explain why the adoption of robo-advisory have not been as successful because it is still a novel innovation. According to Rogers (2003), the innovation decision process and the technology acceptance process are influenced by the spread of the new technology. The new technology needs to accept the time aspect of the adoption and likewise the communication is affected by how fast the innovation diffusion process will be. In order for the innovation to be useful, the innovation needs to be accepted and adopted by the members in a social system so the information can be shared to other systems. (Rogers, 2003) Robo-advisory has not gone through this process yet since 13% are currently using or have used robo-advisory but 77% believe it will be an successful investment alternative in the future. The reason could be that robo-advisory is in an early stage of the innovation decision process and the technology acceptance process, so the product is still very novel for the customers. If the product is novel for customers, trust can be an issue. Previous research shows that trust is a significant factor regarding customers adoption and attitudes towards internet banking. Consumers connect uncertainty and risk to internet banking services. (Suh and Han, 2002) The results may give use a guidance regarding trust, only 20% answer that they trust robo-advisors. This can indicate that robo-advisory need to go through Rogers (2003) processes in order for the 77% respondents to be able to trust the robo-advisory and invest through it. Trust have an impact on an individual's adoption of technology. The result demonstrates that the likelihood of using robo-advisory decreases for individuals who perceive more trust in human advisories. These result corresponds to the hypothesis in table 3.2 and can be supported by previous research about trust and the adoption of Internet banking. Trust is one of the most significant factors regarding adoption of Internet

banking (Suh and Han, 2002), which can also be applied to robo-advisory due to it being a type of Internet banking service.

The majority of individuals who have never invested via a robo-advisor also thinks that it should be more transparent and furthermore require more knowledge about robo-advisors. This results imply that firms need to be more transparent and give more information when marketing their robo-advisors. According to previous research about trust, consumers increase their trust level in technology that they understand. (Suh and Han, 2002) Improving robo-advisory also reduces asymmetric information on the financial market due to lowering the incentives of making financial investments based on personal interest for the possible gain that a human advisor would receive when investing in specific securities. (Madhani, 2010)

4.2.4 Motivation and Sustaining Innovation

Developing and improving an innovation continuously after introducing the product or service to the market are important to create a sustaining innovation that will be adopted by the social system as Rogers (1962) and Christensen (1997) highlights. Therefore, it is important to consider the consumers needs and investigate what consumers thinks should be improved regarding robo-advisors that currently exist on the market. The result shows that the majority of the individuals who thinks that robo-advisory should be free of cost are individuals that have not invested via a robo-advisor before. This indicates that firms could lower the fee for using robo-advisors or highlight the benefits that the consumers would receive by paying the fee and investing via a robo-advisor. This may increase the motivation to use robo-advisors. According to the Motivational Model (Davis, et. al., 1992) the probability of using a specific technology is affected by consumers perceiving that they would gain a reward (revenue) by using the technology.

4.3 Analysis of the Regressions

4.3.1 Gender

Investing in securities can be associated with high risks. Being a female decreases the likelihood to invest in securities with 17% and increases the likelihood with 22% to invest via robo-advisory. Previous research states that women are more risk averse and make safer investment choices (Jianakoplos & Bernasek, 1998) and have lower financial knowledge and confidence than men. (OECD, 2013) The results support the previous research. 90% of the male respondents invest based on their own analysis while 61% of the female respondents do it. The reasons for the differences can be due to women having lower financial knowledge and confidence. This could be connected to why being a female increases the likelihood to invest via robo-advisory. Women do not have the same confidence and knowledge as men have. Therefore they prefer someone else doing the investment choice for them which the results support. 31% of the females answered that they invest through human advisory while only 8% of the men answered that they invest through human advisory. Previous research has also proven that women prefer personal contact since they believe that it is more risky to get information and services direct from the digital media. (Ramón-Jerónimo, Pearl- Pearl & Villarejo-Ramos, 2013)

4.3.2 Income and Monthly Savings

There is a positive correlation between income and monthly savings. Having the possibility to set up monthly savings also create the possibility to invest. The probit regression results for securities shows that the likelihood of investing in securities for individuals who saves over 1 000 SEK increases, which correspond to the hypothesis in table 3.2. This can be supported through the theory of planned behavior (TPB), which demonstrate that perceived behavioral control impacted by perceived possessing of resources affect an individual's intention of doing an desired act and executing that act. (Ajzen, 1991) Having the monetary resources increases the likelihood of saving and investing. There are also several

reasons for individuals choosing not to invest in securities. The results shows that not having enough knowledge are the main reason for people not investing in securities. This can also be supported though the theory of planned behaviour. Lacking knowledge resource decreases the likelihood of performing an act like financial investing.

4.3.3 Education

Unlike the previous research that propose one more year of schooling increases the likelihood of owning securities, the regression with securities as dependent variable shows that having a bachelor's degree decreases the likelihood of investing in securities, which do not correspond to the hypothesis that "Those with higher education will probably be more likely to invest in securities and robo-advisory". This result is odd due to the fact that the majority of previous research present that having higher education increases the probability of financial investing (Cole, Paulson & Shastry, 2014)

4.3.4 Risk

The factor risk have a great impact on technology adoption, perceived higher risk have an negative impact on adoption. (Bussakorn and Dieter, 2005) The probit regression for robo-advisory present that the likelihood of using robo-advisor increases for individuals who perceive themselves wanting to take minimal risk. 2% of all male respondents and 20% of all female respondents chose that alternative. More women want to take minimal risks and associate the use of robo-advisory with little risk. This can be connected to people that perceive that using robo-advisory is a safer choice and rely more on it than investing by themselves. The result also corresponds to the hypothesis in table 3.2 and could also be related to the results from question eleven, that males invest based on their own information and analysis more than females.

When individuals perceive that the risk is higher for robo-advisory compare to human advisory, the likelihood of using robo-advisory decreases. This correspond to the hypothesis ''the higher perceived risk of robo-

advisory, the more likely the individual will prefer human advisory". These results can be supported by the risk theory, which claims that higher perceived risk impact technolgy adoption negatively. (Bussakorn and Dieter, 2005)

4.3.5 Usability

The regression result indicates that the likelihood of using robo-advisory decreases for individuals who perceive that the usability for robo-advisory are lower than for human advisory, which correspond to the hypothesis. This can be explained by the unified theory of acceptance and use of technology (UTAUT) and the technology acceptance model (TAM). According to the theories, effort expectancy that refers to the degree of ease associated to using the system and perceived usefulness impact the behavioral intention and use. This results in the probability of using a particular system such as robo-advisory increases if the individuals finds the system useful and easy.

CHAPTER 5

Conclusion and Further Research

5.1 Conclusion

The propose of this thesis is to investigate if robo-advisory has been adopted in Sweden and what attitudes consumers have toward robo-adviory on the Swedish financial market. We also want to investigate which personal traits and behavioural factors impact the consumers investment decision. Through a survey, primary data was collected to investigate these research questions. Hopefully, a contribution to a quite new research area has been made.

Robo-advisory is a fairly novel innovation on the Swedish financial market and has not been adopted widely within the consumers of this market. The reason for this results may be the attitudes that the consumers have toward robo-advisory. Robo-advisory is currently in an early phase were further development and spreading is necessary in order to be adopted by mainstream consumers. Transparency and more knowledge regarding robo-advisory are requested by the consumers in the Swedish financial market in order to adopt this innovation.

The most significant personal traits that have an impact on consumers decision to invest in securities are gender and education. Monthly savings also have a significant impact whether an individual invest in securities or not. Regarding the use of robo-advisory there are several personal traits

and behavioural factors that have a significant impact on the decision to invest via a robo-advisor or not. The personal traits are gender and risk perception. The significant behavioural factors are effort expectancy, performance expectancy and trust.

5.2 Future Research

During the thesis research we have discovered several other interesting research areas. The time to study more areas has not been available and we want to make proposals for further research:

- In this thesis a quantitative method was used. For further research a qualitative survey could be combined with interesting results in order to get a deeper understanding for the adoption and which personal traits that are significant.
- It would be interesting to do a study to see how the development of adoption has been in the US from a corporate point of view.
- Lastly, this thesis was made by analyzing the consumers perspective and it would be interesting to investigate the companies providing robo-advisory and their point of view regarding the consumer adoption and how they better could match the consumers needs to receive a faster adoption.

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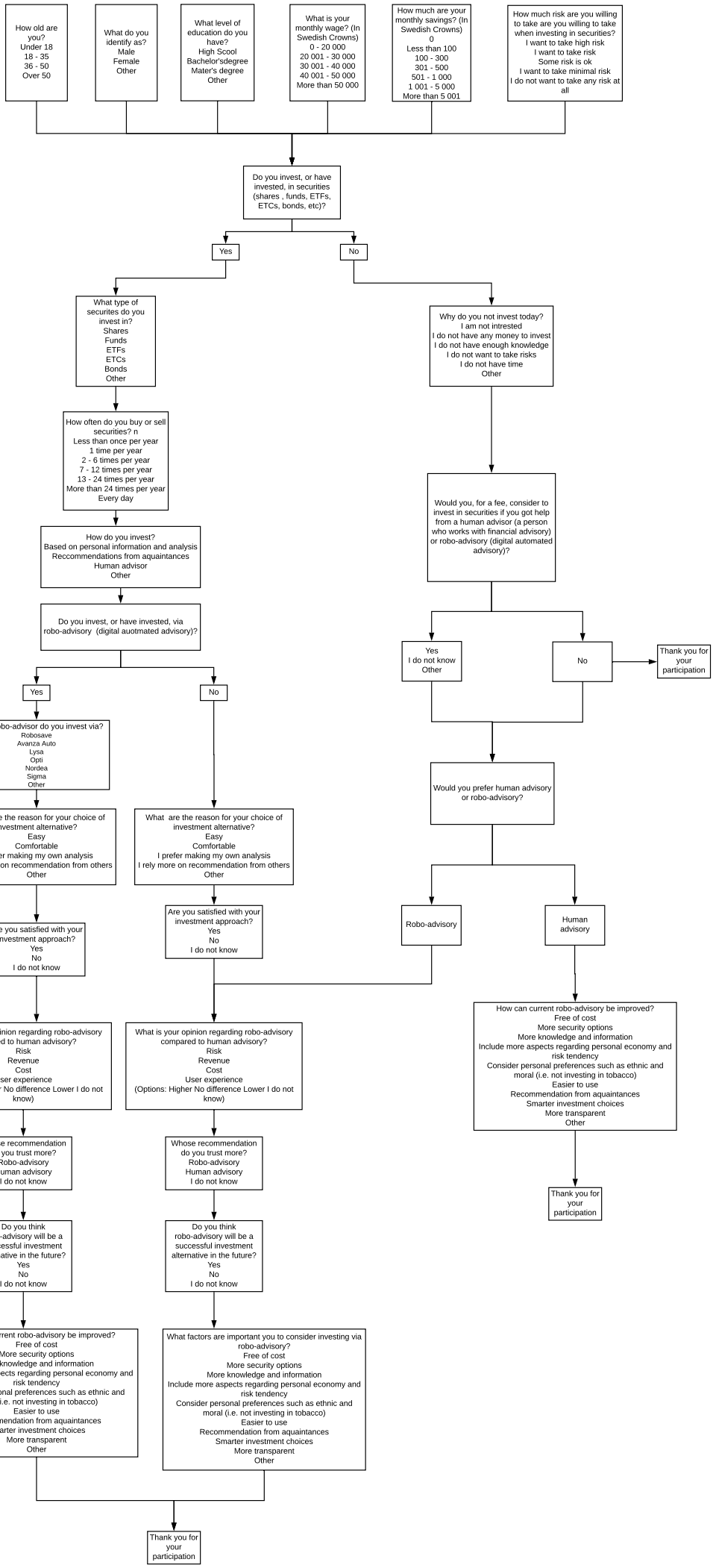
APPENDIX A

Survey layout


How old are you?
Under 18
18 - 35
36 - 50
Over 50
What do you identify as?
Male
Female
Other
What level of education do you have?
High Scool
Bachelor'sdegree
Mater's degree
Other
What is your monthly wage? (In Swedish Crowns)
0 - 20 000
20 001 - 30 000
30 001 - 40 000
40 001 - 50 000
More than 50 000
How much are your monthly savings? (In Swedish Crowns)
0
Less than 100
100 - 300
301 - 500
501 - 1 000
1 001 - 5 000
More than 5 001
How much risk are you willing to take are you willing to take when investing in securities?
I want to take high risk
I want to take risk
Some risk is ok
I want to take minimal risk
I do not want to take any risk at all
Do you invest, or have invested, in securities (shares , funds, ETFs, ETCs, bonds, etc)?
Yes
No
What type of securites do you invest in?
Shares
Funds
ETFs
ETCs
Bonds
Other
Why do you not invest today?
I am not intrested
I do not have any money to invest
I do not have enough knowledge
I do not want to take risks
I do not have time
Other
How often do you buy or sell securities? n
Less than once per year
1 time per year
2 - 6 times per year
7 - 12 times per year
13 - 24 times per year
More than 24 times per year
Every day
How do you invest?
Based on personal information and analysis
Reccommendations from aquaintances
Human advisor
Other
Would you, for a fee, consider to invest in securities if you got help from a human advisor (a person who works with financial advisory) or robo-advisory (digital automated advisory)?
Do you invest, or have invested, via robo-advisory (digital auotmated advisory)?
Yes
I do not know
Other
No
Thank you for your participation
Yes
No
Which robo-advisor do you invest via?
Robosave
Avanza Auto
Lysa
Opti
Nordea
Sigma
Other
Would you prefer human advisory or robo-advisory?
What are the reason for your choice of investment alternative?
Easy
Comfortable
I prefer making my own analysis
I rely more on recommendation from others
Other
What are the reason for your choice of investment alternative?
Easy
Comfortable
I prefer making my own analysis
I rely more on recommendation from others
Other
Robo-advisory
Human advisory
Are you satisfied with your investment approach?
Yes
No
I do not know
Are you satisfied with your investment approach?
Yes
No
I do not know
What is your opinion regarding robo-advisory compared to human advisory?
Risk
Revenue
Cost
User experience
(Options: Higher No difference Lower I do not know)
What is your opinion regarding robo-advisory compared to human advisory?
Risk
Revenue
Cost
User experience
(Options: Higher No difference Lower I do not know)
How can current robo-advisory be improved?
Free of cost
More security options
More knowledge and information
Include more aspects regarding personal economy and risk tendency
Consider personal preferences such as ethnic and moral (i.e. not investing in tobacco)
Easier to use
Recommendation from aquaintances
Smarter investment choices
More transparent
Other
Whose recommendation do you trust more?
Robo-advisory
Human advisory
I do not know
Whose recommendation do you trust more?
Robo-advisory
Human advisory
I do not know
Thank you for your participation
Do you think robo-advisory will be a successful investment alternative in the future?
Yes
No
I do not know
Do you think robo-advisory will be a successful investment alternative in the future?
Yes
No
I do not know
How can current robo-advisory be improved?
Free of cost
More security options
More knowledge and information
Include more aspects regarding personal economy and risk tendency
Consider personal preferences such as ethnic and moral (i.e. not investing in tobacco)
Easier to use
Recommendation from aquaintances
Smarter investment choices
More transparent
Other
What factors are important you to consider investing via robo-advisory?
Free of cost
More security options
More knowledge and information
Include more aspects regarding personal economy and risk tendency
Consider personal preferences such as ethnic and moral (i.e. not investing in tobacco)
Easier to use
Recommendation from aquaintances
Smarter investment choices
More transparent
Other
Thank you for your participation