Investment Strategies of German Households in a Multi-layer Portfolio Framework

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This paper uses data from the Deutsche Bundesbank Panel on Houshold Finances. The results published and the related observations and analysis may not correspond to results or analysis of the data producers.

Geleitwort

Innerhalb des Forschungszweiges der Finanzmärkte im Allgemeinen sowie des Bereichs der Behavioral Finance und des Entscheidungsverhaltens unter Risiko mit hoher Bedeutung für eine Volkswirtschaft (Eigen- und Fremdkapitalmärkte, Unternehmenskontrolle, Corporate Governance) im Besonderen wird noch immer sehr wenig die Portfoliobildung der privaten Haushalte einerseits und das zugehörige Beziehungsgeflecht der Verhaltensweisen, Verhaltensmuster und Verhaltensänderungen im Kontext des finanziellen Entscheidungsverhaltens privater Investoren andererseits analysiert. Man gewinnt den Eindruck, dass in der Literatur immer noch eher das modellhafte, wenig realitätsnahe und kaum empiriegeleitete Paradigma des Rationalverhaltens eines Homo oeconomicus dominiert, auch wenn in den letzten Dekaden verstärkt eine empirische und insbesondere experimentelle Finanzmarktforschung an Bedeutung gewinnt und dabei mit der Behavioral Portfolio Theory (BPT) von Shefrin und Statman bereits länger eine theoretische Grundlegung verfügbar ist; ebenso auch eine solche zur Schätzung der absoluten und relativen Risikoaversion. Die vorliegende Arbeit geht den nicht einfachen Weg, diesen Mangel zu beheben, indem nicht nur statistisch-ökonometrische, sondern insbesondere ökonomische Aspekte des Risiko-Entscheidungsverhaltens mit dem Fokus auf die Portfoliobildung analysiert werden und hierbei auch interdisziplinär Ansätze aus den Verhaltenswissenschaften umfassend berücksichtigt und gewürdigt werden. Hervorzuheben ist die nicht nur theoretische, sondern ebenso die fundierte empirische Analyse unter Nutzung umfassender Datenbasen der Deutschen Bundesbank.

Herr Horn leistet mit der vorgelegten Dissertation einen Beitrag zur Schließung der bestehenden Forschungslücke und widmet sich daher einer zweigeteilten Fragestellung:

(I) Eine Einschätzung, ob die Behavioral Portfolio Theory die Anlageentscheidungen privater Haushalte besser erklären kann als neoklassische Modelle.

(II) Eine Analyse des Anlageerfolgs privater Haushalte unter Einbezug der Behavioral Portfolio Theory.

Im Gegensatz zum Großteil der bisherigen Forschung soll dabei der Fokus der Analyse auf die Behavioral Portfolio Theory gelegt und gleichzeitig die Effizienz real bestehender Portfolios privater Investoren untersucht werden, unter intensiver Nutzung der von der Deutschen Bundesbank im Rahmen des Panel on Household Finances (PHF) zur Verfügung gestellten Daten. Der Deutschen Bundesbank und der zugehörigen Forschungseinheit sei für die großzügige Unterstützung ausdrücklich gedankt.

Die Dissertation von Herrn Horn unterscheidet sich dabei in den forschungsleitenden Fragestellungen in einigen für die wissenschaftliche, aber genauso auch für die praktische Arbeit wesentlichen Aspekten von verwandten Arbeiten. Herr Horn formuliert mit der genannten Zielsetzung seiner Arbeit fünf Kernfragen als besonders relevant:

(1) Unterscheidet sich die relative Risikoaversion der Haushalte im Kontext des Spekulationsportfolios von ihrer relativen Risikoaversion im Kontext des Gesamtportfolios?

(2) Erklärt der Wert des Spekulationsportfolios die relative Risikoaversion im Spekulationsportfolio besser als das Gesamtvermögen der Haushalte die relative Risikoaversion im Gesamtportfolio?

(3) Hängt die Effizienz des Spekulationsportfolios der Haushalte für eine buy-and-hold Strategie von ihrem Gesamtvermögen oder dem Wert ihres Spekulationsportfolios ab?

(4) Verbessert sogenanntes Rebalancing die Effizienz der Spekulationsportfolios der Haushalte?

(5) Hängt der Effekt von Rebalancing auf die Effizienz des Spekulationsportfolios der Haushalte von ihrem Gesamtvermögen oder dem Wert ihres Spekulationsportfolios ab?

Im Unterschied zu bisherigen Arbeiten in diesem Themenfeld legt Herr Horn den gut begründeten Fokus auf die direkte Verknüpfung der Forschung zu Entscheidungsfaktoren wie die relative und absolute Risikoaversion einerseits und zu Performanceanalysen der empirischen Finanzmarktforschung andererseits.

Die vorliegende Arbeit ist damit grundsätzlich im Forschungsgebiet der theoretischen und empirischen finanzwirtschaftlichen Forschung angesiedelt. Sie legt ihren Schwerpunkt auf die direkte Verknüpfung der Forschung zu Entscheidungsfaktoren wie zum Beispiel der Risikoaversion einerseits und zu Performanceanalysen der empirischen Finanzmarktforschung andererseits.

Die empirische Arbeit zeigt je nach ausführlicher Herleitung und Begründung des gewählten Designs und der Datenbasis thesengeleitet die wesentlichen Ergebnisse zu den empirischen forschungsleitenden Fragen auf. Die empirische Arbeit besticht nicht nur durch ihre präzise Anlage in Design und Auswertung, sondern auch durch die kritische Einschätzung der Ergebnisse. Die empirischen Ergebnisse werden in hervorragender Weise untereinander und mit den theoretischen Überlegungen amalgamiert. Es entsteht damit ein sehr ausgewogenes Gesamtwerk der theoretischen und empirischen Forschungsergebnisse.

Bamberg im Dezember 2018 Univ.-Prof. Dr. Andreas Oehler

Vorwort

Die vorliegende Arbeit wurde im Wintersemester 2018/2019 an der Fakultät Sozial- und Wirtschaftwissenschaften der Otto-Friedrich-Universität Bamberg als Dissertation angenommen. Die Entstehung der Arbeit wäre ohne die Unterstützung zahlreicher Personen nicht möglich gewesen, denen ich hiermit herzlich danke.

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Der Deutschen Bundesbank und Dr. Martin Eisele danke ich für die Bereitstellung der PHF-Daten.

Während meiner Zeit als Doktorand am Lehrstuhl für Finanzwirtschaft haben meine Kollegen mich über die gesamte Zeit mit zahlreichen Anregungen unterstützt und ein angenehmes Arbeitsklima ermöglicht, dafür möchte ich ihnen danken. Insbesondere danke ich Herrn Prof. Dr. Tim Herberger, Herrn Dr. Henrik Schalkowski, Herrn Dr. Florian Wedlich und Herrn Prof. Dr. Stefan Wendt für die konstruktive Zusammenarbeit an gemeinsamen Forschungsprojekten sowie die gemeinsamen Konferenzteilnahmen. Herrn Prof. Dr. Stefan Wendt danke ich darüber hinaus ganz herzlich für die zahlreichen Diskussionen und das kritische Lesen der Arbeit. Seine Unterstützung hat maßgeblich zum Gelingen meines Promotionsvorhabens beigetragen.

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Mein größter Dank gilt meiner Familie, insbesondere meinen Eltern und meinen Schwiegereltern und besonders meiner Frau Thea. Sie haben mir jederzeit Rückhalt gegeben, auch dann als sie selbst mit Schicksalsschlägen und anspruchsvollen Lebensumständen konfrontiert waren. Ohne ihre Ermutigung und Unterstützung und die damit geschaffenen Freiräume hätte diese Dissertation nicht entstehen können. Ihnen und Lina ist diese Arbeit gewidmet.

Bamberg im Dezember 2018 Matthias Horn

Table of contents

List of tables

List of figures

List of abbreviations

ARA ..... Absolute Risk Aversion
BPT ..... Behavioral Portfolio Theory
CAPM ..... Capital Asset Pricing Model
CPCM ..... Consumption and Portfolio Choice Model
e.g. ..... exempli gratia (for example)
ed. ..... edition
Ed. ..... Editor
Eds. ..... Editors
et al. ..... et alii
etc. ..... et cetera (and so forth)
ETF ..... Exchange Traded Fund
f. ..... And the following one
ff. ..... Following pages
FKP ..... Financial Knowledgeable Person
i.e. ..... id est (in other words)
Med. ..... Median
MVT ..... Mean-variance Portfolio Theory
OLS ..... Ordinary Least Squares
p. ..... Page
PHF ..... Panel on Household Finances
pp. ..... Pages
RQ ..... Research Question
RRA ..... Relative Risk Aversion
Std. ..... Standard deviation
US ..... United States (of America)
VIF ..... Variance Inflation Factor

List of symbols

Age_h	Age of the FKP of household h in years
Age^2_h	Squared age of the FKP of household h in years
$AllFinLitQuestionsCorrect_h$	Dummy variable that indicates whether household h answered all three questions on financial literacy correctly
$ApprIncome_h$	Assessment of household h whether the household income is appropriate to make ends meet
$ArticlesOfGreatValue_h$	Percentage of portfolio invested in articles of great value
ASR_h	Adjusted Sharpe-Ratio for the portfolio of household h
ASR-Factor	Penalty (gain) factor for negative (positive) skewness and excess (limited) kurtosis
$Bonds_h$	Percentage of portfolio invested in bonds
$Child_h$	Dummy variable that indicates whether at least one child at the age of 16 or younger lives in household h
$\triangle ASRFactor_h$	Difference of the ASR-Factor of the portfolio of household h with portfolio rebalancing and the ASR-Factor of the portfolio of household h without portfolio rebalancing
$\triangle SR_h$	Difference of the Sharpe-Ratio of the portfolio of household h with portfolio rebalancing and the Sharpe-Ratio of the portfolio of household h without portfolio rebalancing
η	Wealth elasticity of ω_h, with $\eta=0$ implying constant, $\eta<0$ increasing, and $\eta>0$ decreasing RRA
$Female_h$	Dummy variable that indicates whether the FKP of household h is female
$FutSavings_h$	Assessment of household h whether the household will be able to save money in the next year
$Graduation_{FKP,h}$	The highest educational achievement of the FKP of household h

$Income_h$	Monthly net income of household h in EUR
$Kurtosis_h$	Kurtosis of the return distribution of the portfolio of household h
μ	Mean portfolio return
$MoneyMarket_h$	Percentage of portfolio invested in cash(-equivalents)
$PercentageRisky_{h,CPCM}$	Risky asset share of the entire portfolio of household h
$PercentageRisky_{h,SP}$	Risky asset share of the speculation-portfolio of household h
$ProfessionalQualification_{FKP,h}$	The highest training qualification of the FKP of household h
$RealEstateFunds_h$	Percentage of portfolio invested in real estate funds
$RiskAtt_h$	Self-assessed risk attitude of household h
$RL_{h,T}$	Return loss of the speculation-portfolio of household h in time period T
σ	Standard deviation of returns
$\sigma_{h,T}$	Standard deviation of the portfolio returns of household h in the time period T
$Skewness_h$	Skewness of the return distribution of the portfolio of household h
$SR_{h,T}$	Sharpe-Ratio of the speculation-portfolio of household h in time period T
$Stocks_h$	Percentage of portfolio invested in stocks
$TWealth_h$	Total Wealth of household h in EUR
$UV_{h,T}$	Unnecessary volatility of the speculation-portfolio of household h in time period T
$ValueSP_h$	The value of the speculation-portfolio of household h in EUR
ω_h	Risky portfolio share of household h
$\omega_{h,SP}$	Portfolio risk of the speculation-portfolio of household h
W_h	Wealth of household h

ξ_h	Vector of the risk preferences and other (partially unobservable) characteristics of household h

1 Introduction

1.1 Motivation and Research Questions

In his 2006 Presidential Address to the American Finance Association John Campbell defined *household finance* as an economic field that "asks how households use financial instruments to attain their objectives"[1]. Household finance can be subdivided in normative and positive household finance.[2] While "normative household finance studies how households *should* choose when faced with the task of managing their finances", "[p]ositive household finance studies instead actual financial decisions taken by households and contrasts them with the prescriptions of normative models"[3]. The relevance of household finance is underpinned by those studies finding that private households hold more assets and liabilities than the corporate sector[4] and others pointing out possible consequences of households' financial behavior, e.g., that the over-leverage of private households catalyzed the recent economic crisis.[5]

Households' portfolio choice, i.e., the decision which percentage of the investable wealth to invest in which risky and virtually risk-free assets, is probably still the most frequently discussed and puzzling topic in the field of household finance.[6] Empirical evidence regarding households' actual portfolios shows that they commonly differ (partially in a substantial way) from benchmarks derived from neoclassical (sometimes also referred as *standard finance* or *traditional finance*[7]) normative portfolio models.[8]

Because of these "wide cracks […] between its theory and the evidence"[9], Statman (2017) claims that "today's standard finance is no longer unified"[10]. To overcome the

[1] Campbell (2006), p. 1553.
[2] See Campbell (2006) and Guiso/Sodini (2013).
[3] Guiso/Sodini (2013), p. 1399 (italics in original).
[4] See Guiso/Sodini (2013), p. 1496.
[5] See Tufano (2009).
[6] See Calvet/Sodini (2014).
[7] See, e.g., Bloomfield (2010).
[8] See Campbell (2006) and von Gaudecker (2015). For a systematic overview of heuristics that households use in decision making and so-called *biases* and *anomalies* that reflect deviations of households' actual investments from the neoclassical benchmarks see Oehler (1992) and (1995), pp. 26 ff.
[9] Statman (2017), p. 3.
[10] Statman (2017), p. 3. Nevertheless, neoclassical models provide some appealing features that are worth to be adopted in positive household finance models, see e.g. Das et al. (2010) or Thaler (2016) stating "that we should not expect some new grand behavioral theory to emerge to replace the neoclassical paradigm, [which …] does a really good job of characterizing how optimal choices and equilibrium concepts work" (p. 1592).

shortcomings associated with the neoclassical normative models[11], Shefrin/Statman (2000) developed the Behavioral Portfolio Theory (BPT) as a positive portfolio model. Yet, empirical analyses applying the BPT on household-level field data such as Oehler/Horn/Wedlich (2018) are few and far between.[12] Consequently, empirical evidence on households' investment decisions in the context of the BPT is by and large missing. This doctoral thesis tackles this gap in the literature by pursuing the following two aims:

- To assess whether the BPT better explains households' actual portfolio choice than neoclassical portfolio choice models.
- To analyze households' portfolio performance within the framework of the BPT.

In contrast to the neoclassical portfolio choice models, the BPT considers that participants of real-world financial markets, such as households, do not act as homo economicus.[13] While neoclassical normative models assume that households design one single portfolio covering all their assets to maximize their expected utility, the BPT incorporates households' mental accounting and treats households' portfolios as layered pyramids, in which each layer represents a mental account associated with a want and goal.[14] As a consequence, applying the BPT on field data requires to attribute household's assets to portfolio layers.

Oehler (2015d), Oehler (2017c), and Oehler/Horn/Wedlich (2018) assign financial assets of German households[15] to one out of three portfolio layers (i.e. mental accounts) depending on the financial goal the assets are suitable for. In accordance with the BPT, the three layers build up on each other in a hierarchical structure.[16] The basic layer covers financial assets and products which cover basic financial needs

[11] See, e.g., De Bondt et al. (2008), Oehler (1992), (1995), (2013c) on those shortcomings.
[12] However, Oehler/Horn/Wedlich (2018) focus on the investment decisions of young adults. Hoffmann et al. (2010) analyze the transaction data of an online broker against the background of the BPT.
[13] See Shefrin/Statman (2000). See, e.g., Oehler (2004), (2013c), Oehler/Wendt (2017), Oehler/Herbger/Höfer/Wendt (2015), and Thaler, (2016) regarding the inevitable violation of the concept of the homo economicus by real-world households.
[14] See Shefrin/Statman (2000), Statman (2017), p. 176.
[15] The attribution of financial services and assets to the portfolio layers of a hierarchical structure is also subject to the social security system the households are covered by since some financial assets and products may be substituted by, e.g., plans and insurances included in the social security system (see Oehler/Horn/Wendt/Reisch/Walker (2018) regarding the effects of different social security systems on the asset allocation of young adults).
[16] See Oehler (2017c).

(e.g., liquidity provisions, health care, liability insurance and disability insurance).[17] Once a household reaches the goals associated with the basic layer, the household invests in the second layer.[18] The second layer covers additional financial assets and products that help to retain a similar level of consumption in the future (e.g. retirement provisions and accident insurance).[19] The third portfolio layer, which is referred to as *speculation-portfolio*[20], includes most of a household's frequently tradable risky assets such as stocks, bonds, and real estate funds.[21]

The portfolio choice in households' speculation-portfolios is of particular interest for this thesis's aims. First, the variety of available assets (in terms of (expected) risk and return, duration, and underlying) and the consequent complexity of portfolio choice are higher for the speculation-portfolio than for the two remaining layers. Second, due to the frequent price changes of the assets in the speculation-portfolio, the risk and return characteristics of the speculation-portfolio are subject to continuous variation, while the risk and return characteristics of the two remaining layers are more stable.[22]

The most relevant aspect of portfolio choice – in terms of the influence on the ex post variation of the portfolio's return – is according to the findings of Brinson et al. (1986, 1991, 1995), Hood (2005), and Ibbotson/Kaplan (2000) the investment policy. The investment policy covers two consecutive decisions.[23] First, the selection of asset classes to include/exclude from the portfolio. Second, the determination of the normal weights of the asset classes included in the portfolio. With respect to the impact of the investment policy on portfolio outcomes, the empirical analysis of this thesis focuses on the weights of the asset classes included in households' speculation-portfolio.

In both BPT and neoclassical portfolio choice models, wealth is considered as a main driver of households' risk-taking and, thus, of households' investment policy,

[17] See Oehler (2015d), (2017c), p. 198, and Oehler/Horn/Wendt/Reisch/Walker (2018).
[18] See Oehler (2017c), p. 198.
[19] See Oehler (2015d), (2017c), p. 198, and Oehler/Horn/Wendt/Reisch/Walker (2018).
[20] The term *speculation-portfolio* harks back to the assumption that households could bear a total loss of the included assets since the households' basic and additional financial needs remain covered by the financial assets and products of the first and second layer.
[21] See Oehler (2015d).
[22] In addition, most households hardly would intend or be able to trade the assets of the basic and second layer.
[23] See Brinson et al. (1995), see also Oehler (1995) pp. 62 ff. for a systematic overview of different investment decisions.

however, in differing ways.[24] Neoclassical portfolio choice models state that households' investment policy is determined by households' attitudes toward financial risk in dependence of households' wealth.[25] This concept of *relative risk aversion*[26] (RRA) is used to indicate the proportion of wealth placed into risky assets by the household as a function of wealth.[27] Although, the question if – and if so – how households' RRA changes with the households' wealth is crucial for the field of household finance[28], empirical findings on this question provide a mixed picture.[29]

In contrast to the neoclassical portfolio choice models, the BPT assumes that households' risk attitudes are different for each mental account and determined by the goal the households pursue.[30] Applied on the approach of Oehler (2015d), Oehler (2017c), and Oehler/Horn/Wedlich (2018) this means that households' RRA may be different for the speculation-portfolio than for the remaining portfolio layers.[31] Though, due to the absence of field studies, households' investment strategies for their speculation-portfolio have not been examined yet – leaving unclear how households' RRA in the speculation-portfolio changes with the value of the speculation-portfolio itself. Therefore, the first part of the empirical analysis focuses on the following research questions:

RQ1: Is the households' RRA in their speculation-portfolio different from the RRA in their entire portfolio?

RQ2: Does the value of households' speculation-portfolio better explain the households' RRA in their speculation-portfolio than the households' total wealth explains the RRA in the entire portfolio?

[24] See Shefrin/Statman (2000). See Pratt (1964) regarding investors' utility functions of money and the utility functions' role regarding the proportion of risky assets in investors' portfolios as underlying concept of neoclassical portfolio selection models such as Merton (1969). See also Oehler (1995), pp. 115 f. regarding the role of wealth as determinant of households' investment decisions.
[25] See Merton (1969); Guiso/Sodini (2013), pp. 1424 ff.
[26] See Arrow (1965), Pratt (1964).
[27] See Cohn et al. (1975), Guiso/Sodini (2013), p. 1424, Oehler (1998a).
[28] See, e.g., Campbell (2003) regarding the role of RRA for the determination of the market price of risk.
[29] See Guiso/Sodini, (2013), p. 1433, Oehler (1998a), Paya/Wang (2016).
[30] See Shefrin/Statman (2000), Das et al. (2010).
[31] See Statman (2017), p. 176.

One key assumption of the BPT is that households overlook covariance between the different layers of their hierarchical portfolios.[32] For this reason, the concept of portfolio efficiency is applied separately on every layer of one household's portfolio and not on the entire portfolio of one household as in neoclassical models.[33] This difference is important for portfolio analysis because households with a higher total wealth generally face lower relative fixed participation costs regarding financial markets and instruments.[34] Hence, households with a higher total wealth have access to a larger range of achievable investments.[35] Since a larger range of investments increases the potential benefits of portfolio diversification[36], households with a higher total wealth have more efficient portfolios just by chance.

Empirical support for the latter relations is provided by Goetzmann/Kumar (2008) who confirm a wealth effect on the portfolio diversification of retail investors. In addition, Vissing-Jorgensen (2004) and Calvet et al. (2007) and (2009a) confirm a wealth effect on households' portfolio efficiency. The authors furthermore provide two drivers of this wealth effect: While Calvet et al. (2007) find that more wealthy households have more efficiently diversified portfolios, Calvet et al. (2009a) observe they are more likely to rebalance their portfolio in an efficient manner.

However, it has not been examined yet whether the efficiency of households' speculation-portfolios depends on the speculation-portfolios' values, households' total wealth, or a combination of both. Furthermore, it is unclear whether portfolio rebalancing has a positive effect on the efficiency of households' speculation-portfolios. Since researchers as well as practitioners are divided over the question whether households shall pursue a buy-and-hold strategy[37] or regularly rebalance the asset class weights back to the initial normal weights[38] of the investment policy, the second part of the empirical analysis addresses both approaches with the following research questions:

> RQ3: Do households' total wealth or the value of their speculation-portfolio predict the efficiency of their speculation-portfolios for a buy-and-hold strategy?

[32] See Shefrin/Statman (2000)
[33] See Das et al. (2010).
[34] See Vissing-Jorgensen (2004) and Campbell (2006).
[35] See Campbell (2006), Tracy et al. (1999).
[36] See Statman (1987), (2002).
[37] See French (2008), Dayanandan/Lam (2015), von Gaudecker (2015).
[38] See Bouchey et al. (2012), Harjoto/Jones (2006), Jacobs et al. (2014).

RQ4: Does portfolio rebalancing enhance the efficiency of households' speculation-portfolios?

RQ5: Does households' total wealth or the value of their speculation-portfolio influence the effect of portfolio rebalancing on the speculation-portfolios' efficiency?

The five research questions are empirically analyzed with a cross-sectional approach. The empirical analyses rely on household-level data from the first wave of the Panel on Household Finances (PHF)-Survey provided by Deutsche Bundesbank, which initially covers 3,565 German households. The dataset of the PHF-Survey breaks down households' total wealth into the asset classes required for the derivation of households' speculation-portfolios and contains various household characteristics considered to be crucial for households' portfolio choice. The efficiency of households' speculation-portfolios is calculated with returns of exchange traded funds (ETFs) and of certificates on exchange traded indices over a period of four years.

By applying the approach of Oehler (2015d) and Oehler (2017c) to the data of the PHF-Survey, this thesis's main contribution is to implement the BPT on field data for the first time and to use the hereby gained insights into households' portfolio choice to provide implications for households, researchers, policymakers, and regulators based on positive instead of purely normative household finance[39].

1.2 Research Outline

Chapter 2 presents the theoretical foundations and definitions that are necessary for the upcoming analyses. More specifically, Chapter 2 reviews the neoclassical framework and its assumptions regarding the determinants of portfolio choice and the financial markets. Since, however, the neoclassical assumptions – in particular on real-life human behavior – are considered as "highly implausible"[40], more realistic views on households' portfolio choice from the fields of new institutional economics,

[39] Please note that positive household finance inherently includes a comparison with the normative models.
[40] Thaler (2016) p. 1579.

market microstructure, financial intermediation, and behavioral finance and economics are introduced.

The literature on the determinants of households' portfolio choice is reviewed in Chapter 3 and provides a practically relevant empirical context for the theoretical concepts of Chapter 2. Both the literature review and the upcoming analyses underlie the assumption that one household member is mainly responsible for her household's finances. This household member is referred to as the household's financial knowledgeable person (FKP).[41] Consequently, the determinants of households' portfolio choice also include the personal disposition and situation of the FKP.[42]

Chapter 4 introduces the portfolio models and datasets that build the foundation for the empirical analyses. The household data consists of 3,565 German households from the first wave of the PHF-Survey provided by Deutsche Bundesbank. Besides describing the dataset, the benefits and limitations of using surveys as data source are discussed. Furthermore, Chapter 4 describes the methodology to derive households' speculation-portfolios from the survey data.

Chapters 5 to 7 contain the empirical analyses to tackle the thesis's research questions. The empirical analyses build on the portfolio models introduced in Chapter 4 and the determinants of households' portfolio choice identified in Chapter 3. Chapter 5 addresses RQ1 and RQ2 by examining the influence of the value of households' speculation-portfolio and total wealth on their investment policy. The efficiency of households' speculation-portfolio for a buy-and-hold strategy (RQ3) is analyzed in Chapter 6. In Chapter 7, the buy-and-hold returns of households' speculation-portfolios computed in Chapter 6 are used as benchmarks to assess the efficiency gains/losses of rebalancing strategies (RQ4). Chapter 7 additionally covers an empirical analysis regarding the influence of households' socioeconomics and -demographics on the efficiency gains/losses from rebalancing the speculation-portfolio (RQ5).

In Chapter 8, the findings from Chapters 5 to 7 and their respective general validity are discussed in the context of the literature.

[41] See Kaustia/Luotonen (2016).
[42] See Oehler (1995), pp. 86 ff.

Chapter 9 concludes the thesis with an outline of the main findings as well as implications for households, researchers, policymakers, and regulators.

2 Theoretical Foundations

2.1 Market Participants' Expected Utility and the Efficiency of Financial Markets

Normative household finance and the normative models are built on the expected utility framework of von Neumann/Morgenstern (1944).[43] The expected utility framework states that – if the decision maker's preferences satisfy the four axioms *completeness*, *transitivity*, *independence*, and *continuity* – a decision maker who faces a choice with different outcomes will always choose the alternative that maximizes her expected utility, which is determined by the decision maker's unique utility function.[44]

Financial decisions (i.e. the decision to enter into a financial contract[45] or to trade a financial asset) are usually characterized by a distinct divergence between the moment when a financial decision is made and the point in time of the repayments associated with the financial decision.[46] In the neoclassical framework, financial decisions are decisions under risk.[47] Decisions under risk are characterized by the decision makers' assumption "to know all (possible) states of the nature, the respective (subjective) probabilities of their occurrence, and all alternatives to decide on"[48].[49] In this context, financial risk can be defined as the threat or danger which results from the uncertainty that a financial variable might negatively deviate from the respective expected financial target.[50]

Negative deviations from the expected target can basically result from mistakes of the decision maker in the assessment process or the occurrence of negative

[43] See Schoemaker (1982) for a review of the literature on the expected utility framework.
[44] See Ackert (2014), pp. 26 f., Barberis/Thaler (2003), p. 1069, Oehler (1995), pp. 13 ff., Rengifo et al. (2014), p. 422.
[45] A financial contract is defined as an agreement for the exchange of cash flows as direct payments and/or entitlement(s) to cash flows. Financial contracts can be subdivided in first-order financial titles and second-order financial titles. First-order financial titles are original financial contracts like stocks or bonds. Second-order (or higher-order) financial titles are derivatives that include the entitlement to a first-order financial title (see Hartmann-Wendels et al. (2007), p. 2; Oehler/Unser (2002), p. 17, Oehler (2004)).
[46] See Oehler (2012b), (2012f), (2013b), pp. 16 f., Oehler/Herberger/Höfer/Wendt (2015), p. 39, Oehler/Höfer/Wendt (2014), Oehler/Wendt (2017). This also applies to personal data as asset in the digital world (see Oehler (2016a)).
[47] See Ackert (2014), p. 26; Ricciardi (2008).
[48] Oehler/Herberger/Höfer/Wendt (2015) p. 35. See also Oehler/Unser (2002), pp. 10 ff., Epstein (1999), Smith et al. (2002).
[49] Instead of being treated as a decision under risk, financial decisions could also be seen as a decision under ambiguity "which means a considerable lack of information regarding potential outcomes and the probability of their occurrence" (Oehler/Herberger/Höfer/Wendt (2015), p. 33).
[50] See Bitz (1993), p. 642; Oehler/Unser (2002), p. 21, Oehler/Herberger/Höfer/Wendt (2015), p. 36.

events.[51] In the neoclassical paradigm, however, decision makers are assumed to be "clones" of the idealized concept of homo economicus[52], i.e., they are perfectly informed, rationally[53] deciding individuals who make no mistakes in the assessment and decision process of financial decisions.[54] Hence, negative deviations from the expected target of a financial decision can only result from the occurrence of negative events.

Decision makers are, furthermore, assumed to be risk averse, i.e. wanting to be compensated for taking risk by receiving a commensurate return – otherwise they will refuse to enter into a financial contract or trade a financial asset.[55] To enter into financial contracts or trade financial assets, decision makers usually meet on financial markets.[56]

For the evaluation of whether a financial contract / an asset provides an appropriate (expected) risk-return trade-off, a suitable measure of risk is required. The mean-variance portfolio theory established by Markowitz (1952) suggests measuring an asset's risk as the asset's return variability, i.e. the variance of the asset's return. Besides, Markowitz (1952) points out that including an asset's risk – in addition to the asset's expected return – as determinant of the decision maker's investment choice restrains the decision maker to invest all his funds solely in the asset with the highest expected return. Moreover, the combination of both determinants implies benefits of asset diversification for the decision maker since a portfolio of assets usually shows less return variability than a single asset. The benefits of asset diversification, however, depend on the correlation between the assets' returns. In dependence of

[51] See Oehler (1995), p. 59, Oehler/Herberger/Höfer/Wendt (2015), p. 36.

[52] See Baddeley (2013), pp. 8 f. Kirchgässner (2008), Oehler (2000b), (2002), (2004) on the concept of the homo economicus, economic man, or homo oecomomicus. See also Miller/Modigliani (1961) who define market participants' rational behavior as their preference for "more wealth to less" (p. 412).

[53] Neoclassical models assume an objective rationality, which means that there is no divergence between the decision maker's perceived reality and all information available on reality (see Bamberg et al. (2013), p. 4). Eisenführ/Weber (1999), p. 4 point out that decisions, in fact, cannot be "rational" or "irrational" but "more or less rational". In the following, "rational" is synonymously used for "more rational" and "irrational" is used as a synonym for "less rational".

[54] See Oehler (2006a), Oehler/Herberger/Höfer/Wendt (2015), p. 36, Oehler/Wendt (2017).

[55] See Ackert (2014), p. 27.

[56] See Hartmann-Wendels et al. (2007), p. 2 and Wendt (2011), pp. 11 ff. Financial Markets can be subdivided in primary and secondary markets (see Theissen (1998), p. 6). Primary markets are markets where financial contracts are closed for the first time, e.g., IPO markets (for an overview regarding the German IPO market see Herberger/Oehler (2011), Oehler/Herberger/Horn/Schalkowski (2017), Oehler/Herberger/Horn (2018)). Secondary markets are markets where financial titles are traded (see Oehler (2000c), (2004), (2005b)).

the decision maker's risk attitude she will, therefore, choose the portfolio that provides the highest expected return for a certain expected return variability.[57]

Given the determinants of portfolio choice introduced by Markowitz (1952), the consequent question is: What is the fair price of a certain asset? To answer this question, Sharpe (1964), Lintner (1965), and Mossin (1966) simultaneously developed the Capital Asset Pricing Model (CAPM).[58] The CAPM reflects "a market equilibrium theory of asset prices under conditions of risk [… that helps to explain] the relationship between the price of an asset and the various components of its overall risk"[59]. To derive equilibrium in this market, an infinite number of rationally deciding and utility maximizing market participants are assumed to be able to borrow and lend assets on equal terms.[60] More specifically, market participants can unlimitedly lend cash flows at a fixed interest rate and unlimitedly invest that cash flow in every asset they want, i.e. every amount and every quantity of an asset is tradable. Furthermore, it is assumed that market participants face no market barriers, transaction costs, taxes, and costs for information gathering and processing which leads to homogenous expectations regarding the assets' expected values among participants. If at all, each market participant's transaction only diminutively affects the market outcome, which means that the individual market participant is a price taker. As a consequence, market prices are assumed to include all information on an asset's risk and return, which is why prices work as the decisive coordination mechanism of market participants' asset allocation.[61] Markets that fulfill these assumptions are called perfect and complete financial markets.[62]

Nevertheless, it is not necessary that every single market participant acts fully rationally to achieve a market equilibrium as long as a sufficiently large number of rational market participants acts as if they were fully rational ("as-if" approach).[63] It is

[57] See Chapter 4.1.1 for a more detailed review of Markowitz's (1952) Mean-variance Portfolio Theory.
[58] Further asset pricing models are the Arbitrage Pricing Theory (see Ross (1976)) and the State Preference Theory (see Arrow (1964) and Debreu (1959)). For a detailed review of the CAPM see e.g. Jensen (1972), Fama/French (2004), Perold (2004). Extensions of the CAPM are the three-factor (Fama/French (1992), (1993)), the four-factor (Carhart (1997)) and the five-factor model (Fama/French (2015)).
[59] Sharpe (1964), p. 427.
[60] See, also for the rest of the paragraph, Jensen (1972), Oehler (2000b), (2002) p. 845, Oehler/Unser (2002) pp. 49 ff., Wendt (2011) pp. 12 ff., Oehler/Herberger/Höfer/Wendt (2015), p. 37.
[61] See Cezanne/Mayer (1998), Schmidt/Terberger (2006), pp. 343 ff.
[62] See Franke/Hax (2009), pp. 154 f., Miller/Modigliani (1961), Oehler (2000b), (2005c), (2006a), pp. 298 f., Oehler (2006c), pp. 76 f., Oehler/Unser (2002), p. 3, Schmidt/Terberger (2006), p. 57, Steiner/Bruns (2007), p. 3.
[63] See Oehler (1998b), p. 72, (2006b), (2011), (2012c), (2013c), (2013d).

assumed that the latter market participants use arbitrage strategies to immediately eliminate the effects of some individuals' irrational transactions.[64]

The price of an asset in such a market (equilibrium) consists of two components, the price of time and the price of risk.[65] Regarding the price of risk, it is important to account for Markowitz's (1952) finding that some risks are diversifiable (unsystematic risks) and some are not (systematic risks). Because of the possibility to eliminate unsystematic risks trough diversification, investors are only compensated for taking systematic risks.[66] Under this condition market participants can achieve an optimal risk-return trade-off by holding a portfolio consisting of a risk-free asset and the so-called *market portfolio*, which usually comprises all tradable risky assets.[67]

The CAPM's underlying assumptions lead to a market equilibrium in which asset prices per definition fully reflect all available information regarding the assets' expected risk and return, i.e. the market is efficient.[68] An efficient market provides ideal conditions for market participants' investment decisions since market prices are the only relevant and best possible source of information and, hence, enable an optimal resource allocation.[69] Although the CAPM assumptions are sufficient conditions for market efficiency, they are no necessary conditions.[70] As Fama (1970) points out, even "disagreement among investors about the implications of given information does not in itself imply market inefficiency unless there are investors who can consistently make better evaluations of available information than are implicit in market prices" (Fama 1970, p. 388). Despite the fact that market participants in real-world financial markets are asymmetrically informed, Fama (1970) hypothesizes that financial markets are efficient (Efficient Market Hypothesis), yet, considering market efficiency in three stages according to three subsets of available information: weak, semi-strong, and strong.[71]

Fama (1991) suggests analyzing the existence of these three stages of market efficiency by performing tests for return predictability, event studies, and tests for

[64] See Oehler (1991), (1992), (1995) p. 24, (2000b).
[65] See Oehler/Höfer/Wendt (2013).
[66] See Ackert (2014), p. 28, Chen et al. (2010), p. 11, Oehler/Wendt/Horn (2018).
[67] This issue is known as Tobin-Separation with regard to the work of Tobin (1958).
[68] See, Fama (1970).
[69] See, e.g, Heilmann et al. (2000); Oehler/Heilmann/Läger (2000).
[70] See Fama (1970).
[71] See Oehler (1994), Titan (2015).

price information, respectively.[72] The tests for return predictability cover all types of tests that use publicly available information like past returns, dividend yields, interest rates etc. to forecast the returns of individual assets and returns in the cross-section.[73] Event studies are used to analyze if and how fast new information is (entirely) reflected in assets' quotes.[74] Tests for price information analyze whether some individuals like company insiders, security analysts, and professional investment managers have private information that is not (yet) priced in assets' quotes.[75] The three tests' results pledge for market efficiency if trading strategies that draw on the respective types of information do not yield excess returns (at least after considering transaction costs).[76] This dependence on the measurement of excess returns, however, reveals that market efficiency is not testable per se because all tests rely on an asset pricing model to determine the assets' *fair* or *fundamental value*, which is not known in reality.[77] Excess returns, therefore, could arise from the employed asset pricing model's inaccuracies or inefficiencies of the analyzed markets or both. Analyses of market efficiency consequently always face a joint hypothesis problem.[78] Empirical analyses that utilize the three previously mentioned tests commonly bypass the joint hypothesis problem by assuming that the underlying market models are valid.[79]

From the private households' perspective as investors, the most relevant question regarding market efficiency is whether it is possible for them to achieve excess returns with trading strategies that employ information available for them. Empirical evidence on this question is – compared to academic discussions on comparable topics – unusually clear by pointing out that retail investors and households are on average unable to outperform the market portfolio.[80] On the flipside, this finding's

[72] See also Fama (2014). See, e.g., Oehler (1994) and Wendt (2011), pp. 15 ff. for a detailed discussion.
[73] These studies, e.g., include tests of momentum and reversal strategies (see, e.g., Herberger et al. (2011), Herberger/Horn/Oehler (2015), (2018); See Asness et al. (2013) for an overview on value and momentum strategies).
[74] These studies, e.g., include the impact of political elections on stock prices (see, e.g., Oehler/Walker/Wendt (2013) and Oehler/Horn/Wendt (2017a)).
[75] See, e.g., Oehler/Pukthuanthong/Walker/Wendt (2016).
[76] Excess returns are defined as returns in excess of equilibrium expected returns with similar risk (see Fama (1970)).
[77] See Fama (1991); Oehler/Heilmann/Läger (2001), p. 6; Wendt (2011), p. 17.
[78] See Fama (1991).
[79] See Oehler/Heilmann/Läger (2001), p. 6, Wendt (2011), p. 17.
[80] See Barber/Odean (2000), (2001), Barber et al. (2009), French (2008), Grinblatt/Keloharju (2000), (2009), von Gaudecker (2015). Fama (1998) states that the frequently documented anomalies of price under- and overreactions (see e.g. De Bondt/Thaler (1985), Jegadeesh/Titman (1993)) can hardly be exploited since both anomalies appear in an almost random way and similar frequency.

main implication for households is that instead of trying to outperform the market with trading strategies, “buying a diversified portfolio at the tableau of prices given by the market will obtain a rate of return as generous as that achieved by the experts”[81].

Although the neoclassical models can be employed to analyze economic relationships in market equilibrium on a theoretical basis, the neoclassical assumptions, such as the absence of transaction costs and the possibility to unlimitedly lend and invest money at a fixed interest rate, are unrealistic.[82] Studies in the fields of new institutional economics, market microstructure, financial intermediation, and behavioral finance and economics deviate from the neoclassical assumptions to provide insights from a microeconomic perspective in a more realistic context.[83]

2.2 New Institutional Economics

The paradigm of new institutional economics subsumes the Theory of Property Rights[84], Transaction Cost Theory[85], Information Economics[86], and Principal Agent Theory[87].[88] New institutional economics deviate from the neoclassical paradigm by accounting for asymmetrically distributed information among market participants and their associated costs resulting from information disadvantages and proper processing of contracts[89].[90]

[81] Malkiel (2003), p. 3.
[82] See Oehler (2000b), (2005c), p. 29, Thaler (2016).
[83] See Oehler (2005b), p. 218, (2006c), p. 77, Oehler/Reisch (2008).
[84] See Coase (1937), Alchian (1965), Alchian/Demsetz (1973), Demsetz (1967) for the fundamentals of the Theory of Property Rights.
[85] See Coase (1937), Williamson (1985), (2005) for the fundamentals of Transaction Cost Theory.
[86] See Akerlof (1970) for the underlying principles of Information Economics, i.e. asymmetric information distribution about, e.g., an asset’s quality and contract partners’ intentions among market participants and the consequences for the asset’s market price. See also Alchian/Demsetz (1972).
[87] See Jensen/Meckling (1976), Fama/Jensen (1983) for the fundamentals of the Principal Agent Theory. See Oehler/Schalkowski (2013) regarding the Stewardship Theory that builds on and extends the Principal Agent Theory.
[88] See Cezanne/Mayer (1998), Opper (2001), Picot et al. (2015), p. 57, Richter (1990), Schalkowski (2013), pp. 9 ff., Wendt (2011), pp. 21 ff.
[89] With respect to the point in time when the contract was closed these costs can be subdivided in ex-ante and ex-post costs (see Williamson (1985), p. 20). See also Coase (1988), pp. 6 f., Picot/Dietl (1990).
[90] See Coase (2005), Hummel (1999), p. 206, Oehler (2013c), Oehler/Wendt (2017), Picot et al. (2015), pp. 40 ff., Richter (1990), Richter/Furubotn (1999), pp. 9 ff. The paradigm of the new institutional economics not only covers financial contracts in the sense of financial titles traded on stock exchanges but also relations between market participants and analysts (see e.g. Höfer/Oehler (2013)), contracts between all of the firm’s stakeholders (e.g., employees, suppliers, customers, etc., see Oehler/Höfer/Schalkowski/Wendt (2011), Oehler/Schalkowski/Wendt (2011), (2012a), (2012b), (2013), (2014)), and the relation between firm’s

The information asymmetries among market participants lead to asymmetries in the decision making power and in the distribution of economic consequences.[91] These asymmetries are preconditions for informational risks, delegation risks, and risks regarding the asymmetric distribution of economic consequences, which could cause substantial deviations from market participants' expected outcomes, e.g., if the counterparty exploits its advantageous position.[92] To prevent such critical situations (e.g. moral hazard and hold-up[93]) market participants can try to acquire more information to reduce their informational disadvantage.[94] Furthermore, market participants can try to negotiate contracts that prohibit myopic behavior and/or reward an intended behavior in certain situations. However, these activities cause transaction costs (including costs for information gathering and processing), monitoring costs, and bonding costs.[95] These costs will restrain market participants from assessing all risks associated with a contract, in particular, regarding contracts on credence goods such as financial products.[96] Especially with respect to credence goods, the product's/service's relevant characteristics can neither be fully assessed before nor after the contract was entered.[97] Hence, the decision to enter into a financial contract is rather a decision under ambiguity than a decision under risk.[98]

Since private households commonly have an informational disadvantage compared to other (professional) market participants[99], the implications of new institutional economics for households' investment policy are twofold. First, if households have less relevant information about the traded financial assets than their counterparts, households will very likely suffer from trading losses on financial markets.[100] Hence, households' informational disadvantages can at least partially explain why

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stakeholders before and after an IPO or a mergers & acquisitions transaction (see e.g. Walker et al. (2011), Oehler/Schalkowski/Wedlich (2015)) and the respective asymmetries and risks.

[91] See Oehler/Unser (2002) pp. 197 ff.

[92] A possible consequence is a market failure caused by adverse selection (see Akerlof (1970)).

[93] See Alchian/Woodward (1988).

[94] See Hagen et al. (2013), Oehler (2006a), (2012a), p. 4, (2012c), (2012d), (2017d), Oehler/Höfer/Wendt (2014), Strünck et al. (2012), (2013).

[95] See Oehler/Herberger/Höfer/Wendt (2015).

[96] See Oehler (2012a), p. 4, (2012c), (2012d), Strünck et al. (2012), (2013). These costs and risks also arise on everyday products markets (e.g., health, food and beverages, mobility, telecommunication, etc.; see Bauhus et al. (2012), Oehler (2013a), (2014a), Oehler/Kenning (2013)).

[97] See Oehler (2013c), (2013d), Oehler/Höfer/Wendt (2014).

[98] Oehler/Unser (2002), p. 199, Oehler/Herberger/Höfer/Wendt (2015).

[99] See Barber/Odean (2013), Oehler (2012a), p. 4, (2012c), (2012d), (2014b), Oehler/Kohlert (2009).

[100] See Linnainmaa (2010) who shows that informed traders pick off the limit orders of less informed individual investors resulting in a poor trading performance of the latter market participants.

households on average underperform the market portfolio.[101] Second, if households show a high degree of ambiguity aversion, it is plausible for them to solely invest in the risk-free asset[102], although, the neoclassical models, which treat investment decisions as decisions under risk rather than under ambiguity, would predict that all households should invest at least a small amount of their wealth in the market portfolio[103].[104]

2.3 Market Microstructure

The market microstructure theory comprises studies that analyze the impact of market attributes on the price formation in asset markets.[105] More specifically, market microstructure approaches are used to evaluate – under consideration of market participants' information and decision processes – different institutional settings with the aim to determine the institutional framework that enables market participants and market operators to settle financial transactions as efficient as possible.[106]

While the neoclassical literature assumes that markets operate without cost and friction, it is the essence of market microstructure research to analyze trading costs and market frictions.[107] In most cases, the research focuses on the organization of stock exchanges, particularly regarding the traded objects, trading rules, and trading venue.[108] These variables are calibrated to maximize market liquidity[109] or at least to provide a necessary amount of liquidity that enables market participants to immediately buy (sell) assets without high price premiums (discounts).[110] Market liquidity is the most important feature of markets' operative functionality, which is, in turn, the necessary requirement for a market's informational efficiency.[111]

[101] See Barber/Odean (2013) and Guiso/Sodini (2013), pp. 1471 ff. for an overview.
[102] See Chen/Epstein (2002), Knox (2003).
[103] See Guiso/Sodini (2013), p. 1453, Merton, (1969), (1971), Oehler (2000a), (2000b).
[104] This phenomenon is known as equity premium puzzle (see Mehra/Prescott (1985)).
[105] See Easley/O'Hara (2003), p. 1023, see also O'Hara (1995), p. 1.
[106] See O'Hara (1995), p. 153, Oehler (2001c).
[107] See Stoll (2003), p. 556.
[108] See Oehler (1998b), p. 74, (2000d), (2001c), (2002), pp. 847 f.
[109] Liquidity is understood "as the possibility to buy (or to sell) an asset immediately and anytime in large or small quantities without any additional charge or price increase (or reduction)" Oehler/Heilmann/Läger (2001), p. 1.
[110] See Theissen (1998), p. 56.
[111] See Oehler (2006c).

From the perspective of households, transaction costs such as search and participation costs[112], the non-divisibility of the tradable assets, and funding constraints on real-world financial markets do not provide a microstructure that allows households to (precisely) establish a portfolio in the sense of a neoclassical market portfolio[113].[114]

The inexistence of the market portfolio as investment opportunity implies that households may no longer uniformly invest in a similar portfolio of risky assets. As a consequence, different households may allocate their wealth to different risky assets. Applied to an analysis of households' RRA (see RQ1 and RQ2), households' actual portfolio risk, i.e. their risk-taking, is more accurately measured by the return variability than by the risky asset share of the portfolio[115].

The existence of transaction costs also implies to consider households' relative participation costs in financial markets, i.e. to restrain portfolio analysis on the households that are wealthy enough to efficiently invest in the assets of the considered financial markets and to exclude the remaining households.

2.4 Financial Intermediation

Organized financial markets, e.g. stock exchanges, by themselves are financial institutions that help to balance market participants' supply and demand of financial assets.[116] Hence, stock exchanges are service providers whose service is the intermediation between market participants who aim to close a financial contract.[117] Due to stock exchanges' imperfections, other intermediaries offer services that, e.g., increase the range of available financial contracts and/or provide services that are

[112] E.g. requirements regarding a minimum margin and fees for direct access to stock exchanges.
[113] Curcuru et al. (2010) and von Gaudecker (2015) use field data to show that most households' portfolio can hardly be seen as a clone of the market portfolio.
[114] See e.g. Vayanos/Wang (2003), pp. 1291 f. for an overview of these market imperfections.
[115] Since not all assets in households' portfolios are continuously traded on financial markets, an assessment of these assets' return variability is hardly possible due to lack of observable prices. In this case, the portfolios' risky asset share is the only assessable risk-taking measure.
[116] See Oehler (1998b), p. 73, (2000d), (2002) pp. 847 f., (2006c), (2012a) pp. 3 f., (2013b) pp. 16 ff., Theissen (1998), p. 1.
[117] See Hartmann-Wendels et al. (2007), pp. 2 f.

able to help market participants to reduce the costs associated with the initiation of a financial contract.[118]

In dependence of their services, financial intermediaries can be subdivided in financial intermediaries in the narrow sense[119] and financial intermediaries in the broad sense[120].[121] Financial intermediaries in the narrow sense directly enter into individual contracts with market participants. In these contracts, financial intermediaries in the narrow sense may either be in the role of the financier or in the role of the borrower. This means that if market participants rely on the services of a financial intermediary in the narrow sense, the market participants do not enter into contracts with each other. Instead, the contractual relationship between market participants is replaced by contracts between the market participants and the financial intermediary in the narrow sense. For the market participants, one key advantage of entering into a contract with a financial intermediary is that they very likely have more information about the financial intermediary than about another market participant, which reduces the pre-contract informational asymmetry and the risk of moral hazard after the conclusion of the contract.[122] Furthermore, the features of the financial contracts are tailor-made for the market participants' requirements. This means that financial intermediaries in the narrow sense transform the duration, nominal value, and credit risk of a financial contract for the market participants.[123]

Financial intermediaries in the broad sense support investors to enter into contracts with each other, e.g., by providing advice or brokerage.[124] More specifically, financial intermediaries in the broad sense usually provide services that help market participants to find a counterparty whose objective fits their needs.[125] However, if contract duration and nominal value do not exactly match both market participants'

[118] See Hartmann-Wendels et al. (2007), p. 19, Oehler (2006c), (2015b), Oehler/Horn/Wendt (2018a), (2018b).
[119] Financial intermediaries in the narrow sense are, e.g., banks, central banks, insurance companies, reinsurer, or venture capital funds (see Hartmann-Wendels et al. (2007), p. 3, Oehler (2006c).
[120] Financial intermediaries in the broad sense are, e.g., credit brokers, stock brokers, insurance brokers, rating agencies, and services that provide information regarding financial markets (see Hartmann-Wendels et al. (2007), p. 3, Oehler (2006c).
[121] See, also for the rest of the paragraph, Bitz/Stark (2008), pp. 4 ff., Hartmann-Wendels et al. (2007), p. 3, Oehler (2004), (2005b), (2006c), Oehler/Horn/Wendt (2018a).
[122] See Greenbaum/Thakor (2007), p. 48.
[123] See Bitz/Stark (2008), pp. 2 ff., Hartmann-Wendels et al. (2007), pp. 13 ff., Oehler (1998b), p. 73; Oehler (2000d), Oehler (2002), pp. 847 f., Oehler (2012a), pp. 3 f.
[124] See, also for the rest of the paragraph, Bitz/Stark (2008), pp. 4 ff., Hartmann-Wendels et al. (2007), p. 3, Oehler (2004), (2005b), (2006c), Oehler/Horn/Wendt (2018a).
[125] See Oehler/Horn/Wendt (2018a) on the business models of financial intermediaries in the broad sense enabled by the ongoing digitization.

needs, they are in most cases not counterbalanced by financial intermediaries in the broad sense. As a result of their services' higher degree of standardization, financial intermediaries in the broad sense usually offer their services for lower fees than financial intermediaries in the narrow sense in a comparable domain.

As households do not have perfect financial market access, "financial intermediation is the root institution in the savings-investment process"[126]. Financial intermediaries such as banks and investment companies enable households to invest their savings in risk-free and risky assets. Mutual funds provide households with the opportunity to invest in a variety of stocks and bonds (and at a lower degree in real estate, commodities and other articles of great value) even if households only have low investable wealth.

Mutual funds can be subdivided in actively and passively managed mutual funds.[127] Passively managed mutual funds are index-linked and try to replicate the development of the index as accurate as possible.[128] Passively managed mutual funds are either Exchange Traded Funds (ETFs) or Index Mutual Funds.[129]

Managers of actively managed mutual funds aim at outperforming a self-selected benchmark (in most cases an equity or bond market index) by applying market timing and stock selection/weighting strategies.[130] The investment companies charge a fee for offering the (actively or passively managed) investment services. This fee is collected by reducing the value of the mutual fund by the amount of the previously communicated service fee. Elton/Gruber (2013) show that managers of actively managed funds are on average not skilled enough[131] to realize an investment performance that compensates their higher service fees and that index funds should, therefore, be the investors' choice.[132] As a consequence, this thesis focuses on investments of households in passively managed funds, which reflects the

[126] Gorton/Winton (2003), p. 434.
[127] See Boldin/Cici (2010).
[128] See Boldin/Cici (2010).
[129] See Bhattacharya et al. (2017).
[130] See Admati et al. (1986), Daniel et al. (1997), Kacperczyk et al. (2014), Stark (2018), Wermers (2000).
[131] Oehler/Wendt (2007) show that, additionally, governance conflicts of fund managers may hamper mutual funds' performance.
[132] See Elton/Gruber (2013) pp. 1038 ff. Numerous studies on fund performance, furthermore, show that funds which temporarily outperform their benchmark show no performance persistence (see Barras et al. (2010), Brown/Goetzmann (1995), Busse et al. (2010), Carhart (1997), Carhart et al. (2002), Cremers/Petajisto (2009), Elton et al. (1996), Fama/French (2010), Goetzmann/Ibbotson (1994), Grinblatt/Titman (1992), Hendricks et al. (1993), Jensen (1968), Lehmann/Modest (1987), Malkiel (1995), (2013), Oehler/Höfer/Horn/Wendt (2018), Wagner/Winter (2013)).

widespread suggestion for households "to buy a broad-based index fund that bought and held all the [assets] in the market and that charged very low expenses"[133].

Financial advisers and robo-advisers[134] are financial intermediaries that should support households' portfolio choice.[135] These intermediaries' service consists at least of providing information about (a preselected set of) financial products' (expected) risk and return (including all costs/fees) and the availability of the invested wealth. Some intermediaries additionally (implicitly or explicitly) provide advice regarding the suitability of a financial product (or a set of financial products) to fulfill a household's (specific) financial needs.[136] Besides the ongoing debate about ways to improve the quality of financial advice and the provided information to better fit households' individual needs[137], it particularly remains questionable whether portfolio management services[138] which rebalance households' portfolios – comparable to the market timing services of active fund managers – are beneficial for households.[139]

2.5 Behavioral Finance and Economics

While models and approaches in research on financial intermediation, market microstructure, and new institutional economics rather concentrate on the extent of information that market participants can access and on how more and easier accessible information increase market efficiency, behavioral finance and economics builds up on these approaches and focuses on market participants' behavior regarding information gathering, perceiving, and processing.[140] In contrast to the assumptions of the neoclassical paradigm, behavioral finance and economics is not

[133] Malkiel (2003), p. 4.
[134] Robo-advisers are an automated investment service that helps investors to establish a portfolio of stocks and bonds under consideration of the investors' perceived risk tolerance. Thereafter, robo-advisers rebalance this portfolio to offset the variations induced by asset price movements in order to keep the portfolio's ratio of stocks and bonds constant over time (see Oehler (2015b), Oehler/Horn/Wendt (2016d)).
[135] See Oehler (2015b), p. 28, Oehler/Horn/Wendt (2018a).
[136] See Oehler (2015b), Oehler/Horn/Wendt (2016c), (2017b).
[137] Studies on the quality of financial advice and the provided information regarding financial services both in the analog and digital world usually show that the quality is in need of improvement (see Foerster et al. (2017), Oehler (2004), (2005c), (2006b), (2011), (2012a), (2012b), (2012c), (2012d), (2012f), (2013a), (2013b), (2013c), (2013d), (2014b), (2014c), (2015a), (2015b), (2015c), (2015e), (2016b), (2016c), (2016d), (2017a), (2017c), (2017e), (2018) Oehler/Höfer/Wendt (2013), (2014), Oehler/HornWendt (2016b), (2016c), (2017b), (2017c), Oehler/Kohlert (2009), Oehler/Wendt, (2017)).
[138] Due to the focus on passively managed funds, social trading platforms, which also provide a portfolio management service, are not considered in the following analysis. For a performance analysis of social trading certificates see Oehler/Horn/Wendt (2016a).
[139] See RQ4.
[140] See Oehler (1995) pp. 57 ff., Oehler (2000a), Oehler (2005a), Oehler (2006b), Oehler/Herberger/Höfer/Wendt (2015).

based on the concept of frictionless markets and market participants' full rationality.[141] Instead, market participants are assumed to act bounded rationally.[142] The concept of bounded rationality accounts for market participants' limited cognitive capacity and the necessity to use heuristics and rules of thumb which – although, market participants probably wish to act fully rationally – lead to so-called "anomalies", "irrationalities", or "biases", i.e., decisions of market participants observed in practice that diverge from the decisions predicted by the neoclassical expected utility framework.[143] The implication for the price determination in (financial) markets is that "[m]arkets are not efficient in the sense that prices equal values in them."[144]

However, market participants' "irrationalities" not only hamper efficient price determination but also the participants' financial outcomes[145], which makes markets "efficient in the sense that they are hard to beat"[146]. One (costly) key symptom of households' "irrationalities" is excessive trading.[147] To minimize the negative impact of excessive trading most academics and practitioners suggest that households pursue a simple buy-and-hold strategy.[148]

Nevertheless, the divergences between market participants' actual investment decisions and the decisions predicted by expected utility theory motivated research in the field of behavioral finance to focus on the development of new decision frameworks that better match the observed behavior of market participants than the neoclassical models.[149] Out of these frameworks, the prospect theory by Kahneman/Tversky (1979) is considered as the most successful at capturing market participants' observed behavior and, therefore, most promising for financial applications.[150]

[141] See De Bondt et al. (2008).
[142] See Simon (1955), (1956), Oehler (2004), (2011), (2012d), Oehler/Reisch (2008), Reisch/Oehler (2009).
[143] For an overview see Oehler (1992), (1995), (2013c), Shiller (1999).
[144] Statman (2017), p. 4. See also Shiller (2003), (2014).
[145] See Barber et al. (2009), Barber/Odean (2013), p. 1539, French (2008).
[146] Statman (2017), p. 4.
[147] See Barber/Odean (2000).
[148] See e.g. French (2008), Dayanandan/Lam (2015), von Gaudecker (2015).
[149] This research also relies on insights of other fields such as neuroeconomics and psychology, e.g. to link market participants' behavior with their personality (see Oehler/Wedlich (2018), Oehler/Wedlich/Wendt/Horn (2016), Oehler/Wendt/Wedlich/Horn (2018), Wedlich (2017) and the therein cited literature).
[150] See Barberis/Thaler (2003), p. 1069, Shiller (1999), Thaler (1980).

2.5.1 Prospect Theory

The aim of the prospect theory is to capture decision makers' attitudes to gambles.[151] Hence, the prospect theory does not have a normative but a descriptive aspiration.[152] Kahneman/Tversky (1979) derive the following stylized facts about decision makers' preferences in the context of decision making.[153]

First, the decision maker's utility is derived from changes in wealth relative to a reference point (i.e., gains and losses), rather than levels of wealth, as in the neoclassical paradigm. Second, as illustrated in Figure 1, the value function that describes the transfer of gains and losses into utility has a kink at the origin and is concave for losses (implying that decision makers would act like they were risk-seeking) and convex for gains (implying risk-aversion). Hence, losses more heavily impact the decision maker's utility than gains of the same amount (this phenomenon, which is not existent in a neoclassical setting, is also referred to as loss aversion[154]). Third, decision makers overestimate the probability of occurrence of very seldom alternatives and underestimate the probability of occurrence of very likely alternatives (see Figure 2). Such a skewed probability weighting function does not exist in a neoclassical framework because of the assumption that all decision makers act fully rationally and, as a consequence, accurately assess all scenarios' probabilities of occurrence of a decision.

[151] See Barberis/Thaler (2003), p. 1069.
[152] See Kahneman/Tversky (1979).
[153] See also Thaler (2016), Oehler (1995), pp. 40 ff., Rengifo et al. (2014), pp. 442 ff.
[154] See Benartzi/Thaler (1995), Oehler (2001b).

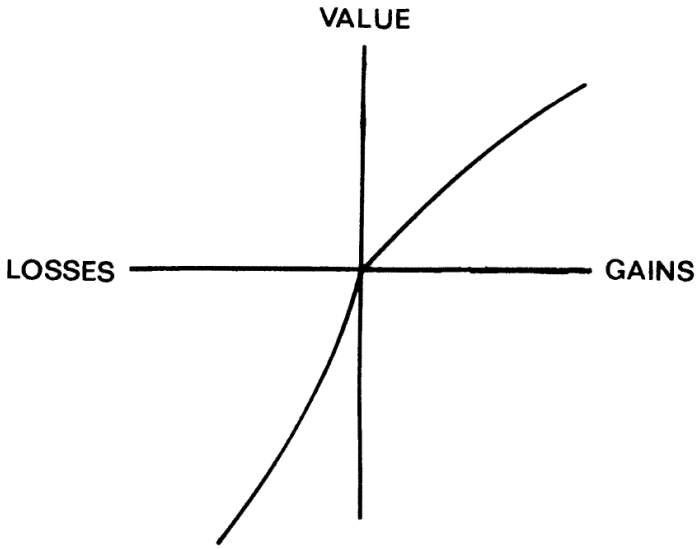

Figure 1: Value Function of Prospect Theory (Source: Kahneman/Tversky (1979), p. 279)

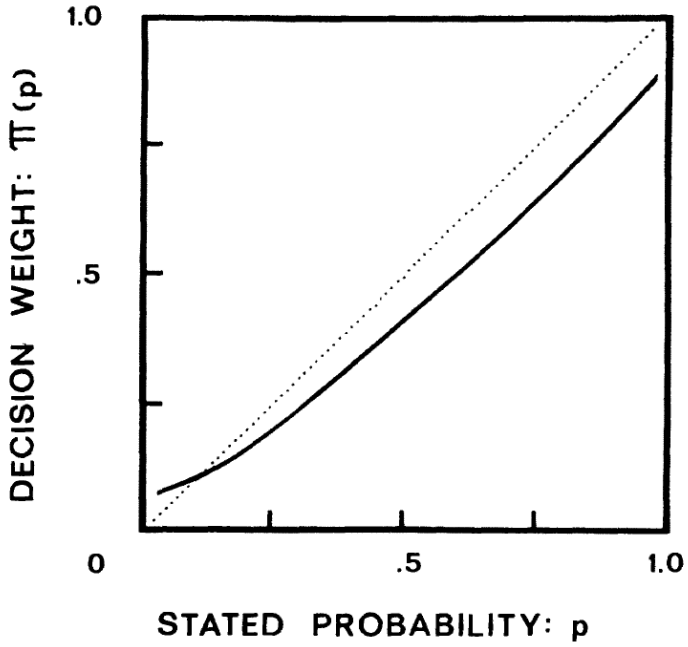

Figure 2: Probability Weighting Function of Prospect Theory (Source: Kahneman/Tversky (1979), p. 283)

The prospect theory's stylized facts about decision makers' preferences have crucial implications for households' financial decision making. The value function's definition over gains and losses reflects households' behavior of not evaluating a financial transaction along with all current financial assets and their future cash flows but of

rather separately evaluating each transaction one at a time.[155] This means it is very unlikely for households to perceive all their assets as constituents of one single portfolio. Instead, households more likely perceive their assets as individual investments, while probably pooling some similar investments (e.g., of one asset category) in one portfolio. Furthermore, if gains and losses impact households' utility in a nonlinear way, households may – because of their loss aversion – choose to not invest in risky assets at all.[156]

2.5.2 Mental Accounting

Decision makers' individual evaluation of each transaction (i.e., separately from the majority of other assets and transactions) as implied by prospect theory is the underlying feature of decision makers' so-called *mental accounting*.[157] "Mental accounting is the set of cognitive operations used by individuals and households to organize, evaluate, and keep track of financial activities."[158] Mental accounting incorporates three key components regarding households' financial decision making.[159] First, households do both ex-ante and ex-post cost-benefit analyses of their financial decisions. Second, households assign sources and uses of funds to specific mental accounts or portfolios. Third, different mental accounts are evaluated in different frequencies. Due to the kink of households' utility function a loss in one mental account can not necessarily be substituted by a gain in another account[160], which is a violation of the economic notion of fungibility.[161]

Shefrin/Thaler (1988) provide indications that households' financial decisions reflect a behavior as predicted by mental accounting theory. By dividing households' wealth in the three mental accounts *current spendable income*, *current assets*, and *future income* Shefrin/Thaler (1988) show that households are much more likely to spend a

[155] See Thaler (1999).
[156] See Barberis et al. (2006), Benartzi/Thaler (1995), Dimmock/Kouwenberg (2010), Siegel/Thaler (1997). One further implication of the prospect theory's utility function for households which invest in risky assets is these households' disposition to sell assets with book profits and hold assets with book losses ("Disposition Effect", see Shefrin/Statman (1985), Heilmann et al. (2001), Oehler (1991), (1999), pp. 72 ff., Oehler/Heilmann/Läger/Oberländer (2003). However, this effect plays a minor role if households solely pursue a buy-and-hold strategy.
[157] See Thaler (1985). Shiller (1999) uses the term *mental compartments* synonymously.
[158] Thaler (1999), p. 183.
[159] See Thaler (1999).
[160] See also Hirshleifer (2015), Oehler (1995), p. 34.
[161] See Levin (1998), Thaler (1990).

dollar from their spendable income account than from their future income account which consists of retirement savings. The latter finding indicates that households are hardly willing to transfer wealth from one mental account to another, even though the households' total wealth would stay the same.

2.5.3 Home Bias

Despite the neoclassical framework predicting that households invest in the market portfolio, empirical evidence shows that households' actual portfolios are home-biased, i.e., households hold a smaller percentage of foreign assets than suggested by neoclassical portfolio theory.[162] However, the role of households' home bias has become less important over time. While early studies have shown that home-biased households refrain from substantially enhancing their risk-return position[163] more recent studies report stronger correlations between different countries' stock[164] and bond markets[165] which decrease – although not disperse – the benefits from international diversification.[166]

Households' home-biased investment decisions are explained by households' (assumed or perceived) superior information and knowledge about domestic, in particular local[167], firms[168], households' optimism regarding domestic firms[169], and higher transaction costs for investments in foreign assets compared to investments in domestic assets[170].[171] However, due to the digitization and increased market integration within the last two decades, transaction cost can hardly serve as main

[162] See French/Poterba (1991), Jeske (2001), Lewis (1999), Oehler (2001a), (2002), pp. 865 f., Oehler/Rummer/Walker/Wendt (2007), Oehler/Rummer/Wendt (2008), Tesar/Werner (1992), (1994), (1995), von Nitzsch/Stotz (2006). For an overview about the equity home bias phenomenon see Cooper et al. (2012).

[163] See Bekaert/Harvey (2000), Errunza (1977), Errunza et al. (1999), Grubel (1968), Levy/Sarnat (1970), Solnik (1974).

[164] See Baele/Inghelbrecht (2009), Bekaert et al. (2009), Christoffersen et al. (2012), Eiling/Gerard (2015).

[165] See Barr/Priestly (2004), Ilmanen (1995), Lamedica/Reno (2007).

[166] A possible explanation for this phenomenon is firms' increasing degree of internationalization (see Oehler/Wendt (2016a), Oehler/Wendt/Horn (2016), (2017)).

[167] See Baltzer et al. (2015).

[168] See Brennan/Cao (1997), Gehring (1993), Oehler/Rummer/Walker/Wendt (2007), Oehler/Rummer/Wendt (2008).

[169] See Shiller et al. (1991), French/Poterba (1991).

[170] See Chan et al. (2005), Dahlquist et al. (2003), Giannetti/Koskinen (2003), Rowland (1999).

[171] For a detailed overview of potential causes of home bias see, e.g., Oehler/Rummer/Walker/Wendt (2007), Oehler/Rummer/Wendt (2008), Graham et al. (2009). See Bekaert at al. (2017) for additional explanatory factors such as access to financial advice, education, financial literacy, and the fraction of foreign-born population in the investor's neighborhood.

explanation.[172] Hence, households' home-biased portfolios can rather be seen as a symptom of households' (over)optimism regarding the quality of their information about domestic firms and their future success. Nevertheless, an analysis of households' portfolio choice has to consider home bias due to its impact on portfolio choice.

[172] See Coen (2001), Cooper/Kaplanis (1994), French/Poterba (1991), Tesar/Werner (1992), (1994), (1995).

3 Determinants of Households' Investment Decisions

The determinants of an individual's investment decisions can be subdivided in personal factors and factors of the individual's environment.[173] Personal factors include an individual's personal disposition and personal situation. The personal disposition comprises e.g. the individual's purpose of investing, personal information, and risk attitude. The personal situation subsumes e.g. the individual's age, gender, qualifications, income, and wealth. Factors of the individual's environment are all external factors that either directly influence the individual or that concern the individual's social surrounding such as family and friends. The impact of the factors of an individual's environment is consequently interrelated to the individual's personal factors.[174] Since the individual's environment is subject to constant change (and therefore also hardly measurable) the personal factors are usually considered as being more significant determinants[175], which is why this thesis focuses on the personal factors.

Applying the determinants of individuals' investment decisions on a household finance level requires the widespread assumption that one household member is mainly responsible for her household's finances. This household member is often referred to as the household's finance responsible or financial knowledgeable person (FKP).[176]

3.1 Personal Disposition

3.1.1 Purpose of Investing

Households engage in investments because they are driven by their individual motives.[177] Synonymously with *motives*, the term *needs* is used in this context as well.[178] Motives can be subdivided in two categories, primary and secondary motives.[179] Primary motives are innate and biologically necessary to keep a person

[173] See Oehler (1995), p. 68, see also Wedlich (2017), pp. 39 ff.
[174] E.g. when the individual's income decreases because she loses her job due to an economic downturn.
[175] See, e.g. Kaustia/Luotonen (2016).
[176] See Kaustia/Luotonen (2016).
[177] See Oehler (1995), pp. 87 ff., Spieß (2005), pp. 58 f.
[178] See e.g., Spieß (2005), p. 58.
[179] See Oehler (1995), pp. 88 ff., Spieß (2005), p. 59.

alive.[180] Secondary motives are learned and connected to the satisfaction of primary needs, e.g. earning money to buy food as secondary motive to satisfy the primary motive of preventing to stave death.[181] The secondary motives of households' investment decisions can be assigned to three main groups of motives: consumption, precaution, speculation.[182] The consumption-motive covers all investments that aim at realizing a future consumption such as a holiday trip, car or other vehicles, electronic appliances, etc. The precaution-motive comprises all investments that help to reduce the financial impact of future dangers and financial risk like health, liability, and disability insurances, liquidity provisions, and retirement savings/provisions.[183] The speculation-motive subsumes investments that aim to fulfill households' need to increase wealth and/or future income. Households' investment decisions regarding risky investments consequently are by and large associated with the speculation-motive.[184]

Aims, or synonymously goals, are considered as concretions of motives.[185] Households' investment aims can be summarized as profitability, safety, and liquidity.[186] Additional aims are ecological and social responsibility.[187] The findings of Shefrin/Thaler (1988) show that households' mental accounts are commonly dedicated to a certain investment goal. While the latter link is not acknowledged in mean-variance portfolio theory, it is central in the Behavioral Portfolio Theory (BPT) and, hence, the key reason to analyze households' speculation-portfolio in this thesis.[188]

[180] See Oehler (1995), p. 88, Spieß (2005), p. 59.
[181] See Oehler (1995), p. 88, Spieß (2005), p. 59.
[182] See Oehler (1995), pp. 88 ff.
[183] See Oehler (1995), pp. 88 ff., Oehler/Horn/Wendt/Reisch/Walker (2018).
[184] Investments in risky assets for the purpose of income hedging (see, e.g., Bonaparte et al. (2014)) may partially satisfy both the precaution- and the speculation-motive. However, survey results are in favor of a dominant role of the speculation-motive when households decide to participate in risky assets (see Oehler (1995), p. 92).
[185] See Oehler (1995), p. 99.
[186] See Oehler (1995), p. 100, Wedlich (2017) p. 47.
[187] See Oehler (2013b), (2014b), Oehler/Horn/Wendt (2018c), Oehler/Wendt (2016b), Statman (2014).
[188] See, Shefrin/Statman (2000), Das et al. (2010), Statman (2014) and Section 4.1.3.

3.1.2 Personal Information / Financial Literacy / Financial Advice

The FKP's personal information comprises a combination of external[189] and internal information. Internal information is driven by the FKP's experiences and knowledge about financial investments.[190]

The emergence of the internet and the ongoing digitization has strongly increased the amount of information reachable for households.[191] Furthermore, the number of investable financial products has surged.[192] Due to the complexity of financial products and investment decisions, a certain level of financial knowledge and understanding is required for households to benefit from the reachable information[193], i.e., households have to have a sufficient level of financial literacy to process the information expedient for their financial decision[194].

Financial literacy can be defined as "the ability to use knowledge and skills to manage one's financial resources effectively for lifetime financial security"[195]. Although this definition already includes the application of one's own knowledge to the real-world investment process, studies on financial literacy commonly use households' answers on theoretical questions about the functioning of financial products, their basic consequences, the necessary numeracy skills, and the knowledge of basic financial concepts such as diversification to measure financial literacy.[196] Most of these studies state that investors with higher financial literacy show a more preferable financial behavior, e.g., establishing financial plans for retirement and wealth accumulation[197], paying lower fees for financial services[198], or paying lower interest rates for borrowed money[199].

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[189] External information are e.g. macroeconomic data and expectations like unemployment and inflation rates as well as information on issuing companies of first-order financial titles such as balance sheet data (see Oehler (1995), pp. 70 ff.).
[190] See Oehler (1995), p. 94. Like the process of gathering, perceiving, and processing external information the process regarding the transformation of experiences and knowledge into internal information is also influenced by individuals' selective perception and heuristics.
[191] See Oehler/Horn/Wendt/Reisch/Walker (2018).
[192] See Balasubramnian/Brisker (2016).
[193] See Braunstein/Welch (2002), Micklitz/Oehler (2006), Oehler/Werner (2008).
[194] See Aubram et al. (2016), Wang (2013).
[195] Hastings et al. (2013), p. 349.
[196] See, e.g., Deuflhard et al. (2015), Lusardi (2015), van Rooij (2012). Exceptions that also include the implementation of financial decisions are Aubram et al. (2016), Bernheim et al. (2001), Deepak et al. (2015), Dixon (2006), Oehler/Horn/Wendt/Reisch/Walker (2018), Oehler/Werner (2008), Xiao/O'Neill (2016).
[197] See Meyll et al. (2018), van Rooij et al. (2012).
[198] See Choi et al. (2011).
[199] See Lusardi/Tufano (2015).

Nevertheless, Hastings et al. (2013) conclude that most studies in the field of financial literacy are inappropriate to draw the conclusion that financial literacy improves financial behavior and outcomes, since these studies do not prove causal inference. Findings of Meyll et al. (2018) and von Gaudecker (2015), furthermore, indicate that households do not necessarily have to be financially literate by themselves but instead can rely on financial advisers or the expertise of private contacts to achieve reasonable financial outcomes.

If households, however, follow the suggestion of academics and financial advisers to solely invest in passively managed index funds, personal information plays a subordinate role since private household are not likely to have personal information exceeding the broadly available information that is already considered in market prices. Hence, in the context of this thesis's research questions, it is more important whether households' financial literacy or their access to financial advice (proxied by households' financial wealth as precondition and catalyst of financial advice[200]) influence households' portfolio choice. Previous findings suggest that portfolios of households with higher financial literacy are more likely to include stocks[201] and to be more efficiently diversified[202].

3.1.3 Risk Attitude

3.1.3.1 Definition

Households' risk attitude is considered as the most important determinant in both theoretical asset pricing models and households' portfolio choice.[203] In this thesis, households' risk attitude (the degree of risk aversion) is defined in dependence of households' utility function.[204] If households face the investment decision to allocate their wealth in a market portfolio and a risk-free asset, households' risk attitude determines the amount or percentage of wealth that the households invest in each

[200] See Hackethal et al. (2012).
[201] See van Rooij et al. (2011).
[202] See Graham et al. (2009), von Gaudecker (2015).
[203] See, e.g., Cohn et al. (1975), Dorn/Huberman (2005).
[204] According to Bitz (1984) this is the definition of risk attitude in the broader sense. Risk attitude in the narrow sense is defined solely in dependence of a risk preference function. The definition of risk attitude in the broader sense always also captures the risk preference function although it is not necessarily possible to isolate the influence of the risk preference function on the utility function (see also Oehler (1995), pp. 104 ff., Oehler (1998)).

asset.[205] In investment decisions like this, households with a higher degree of risk aversion will put a lower amount/percentage of money in the market portfolio and households with a lower degree of risk aversion will put a higher amount/percentage of money in the market portfolio, ceteris paribus.[206]

However, studies in behavioral finance have shown that households' financial portfolio choices do not exactly reflect households' self-perceived financial risk attitude – as neoclassical models assume – although, the financial risk actually taken by households is significantly correlated with households' risk attitude.[207] As a consequence, this thesis follows Nosic/Weber (2010), Oehler/Horn/Wedlich (2017), and Oehler/Wedlich (2018) and employs two measures of risk attitude, one subjective question to measure households' self-assessed risk attitude and households' portfolio data to measure the relative risk aversion as defined by Arrow (1965) and Pratt (1964).

3.1.3.2 Measurement

3.1.3.2.1 Subjective Question

Investors' self-assessed risk attitude is commonly measured by a question that respondents answer on a Likert-Scale. Studies that analyze individuals' risk attitude in multiple domains regularly employ a question asking about an individual's general willingness to take risks ("How willing are you to take risks, in general?").[208] However, a comparative study regarding the predictive power of risk measures in different domains by Dohmen et al. (2011) shows that a "domain-specific risk question is the best predictor"[209] for actual risk-taking behavior.[210]

Consequently, studies in the field of finance frequently use the domain-specific question "Which of the following statements comes closest to the amount of financial

[205] See Arrow (1965), Pratt (1964).
[206] See Nosic/Weber (2010).
[207] See Beauchamp et al. (2017), Dohmen et al. (2011), Halko et al. (2012), Kaustia/Luotonen (2016). Marinelli et al. (2017) analyze the factors that determine the gap between investors' self-perceived financial risk attitude and their actual financial risk. They find that investors with low financial literacy, high income, and no children show a higher gap between self-perceived risk attitude and actual financial risk.
[208] See, e.g., Dohmen et al. (2011).
[209] Dohmen et al. (2011), p. 541.
[210] See also Beauchamp et al. (2017), Bertraut (1998), Guiso/Sodini (2013), Halko et al. (2012), Kaustia/Luotonen (2016), Puri/Robinson (2007).

risk that you/your household are/is willing to take when you save or make investments?'' with the following four answers: "Take substantial financial risks expecting to earn substantial returns;" "Take above average financial risks expecting to earn above average returns;" "Take average financial risks expecting to earn average returns;" "Not willing to take any financial risks;".

Other methods, such as lottery designs, do not provide further explanatory power regarding the respondents' risk-taking in the presence of the domain-specific question.[211] In addition, Kaustia/Luotonen (2016) find that much of the allegedly predictive power ascribed to other characteristics of respondents such as sociability, cognitive skills, health, and height is already captured by respondents' self-assessed risk attitude regarding the financial domain, while factors such as gender, age, income, and wealth still have significant influence on respondents' financial risk-taking behavior.[212] Additionally, Chatterjee et al. (2017) find that households' goal-based savings behavior is positively associated with risk-tolerance.

3.1.3.2.2 Arrow-Pratt-Measures

Pratt (1964) and Arrow (1965) simultaneously developed the concepts of absolute and relative risk aversion to measure risk attitude. These concepts put a household's financial risk-taking in direct relation to its wealth.[213]

The focus of absolute risk aversion (ARA) is on the relation between the amount of money a household invests in risky assets and the household's wealth. If the household increases the amount of money invested in risky assets when the household gets wealthier, the household shows decreasing ARA. If the investments in risky asset are not adapted to varying wealth, the household has a constant ARA. Increasing ARA denotes the behavior to divest risky investments with rising wealth. Due to the general agreement that households' ARA is decreasing[214], this thesis does not further examine this measure but, instead, focuses on households' relative risk aversion (RRA).

[211] See Halko et al. (2012).
[212] See Kaustia/Luotonen (2016).
[213] See Cohn et al. (1975), Oehler (1995), pp. 105 ff., Oehler (1998).
[214] See Guiso/Sodini (2013), p. 1433, Oehler (1995), p. 108, Oehler (1998).

RRA deals with the relation between a household's wealth and the percentage of wealth the household invests in risky assets. If a household increases the percentage of risky assets in its portfolio with rising wealth, the household shows decreasing RRA. If a household keeps the risky asset share of its portfolio constant while the household's wealth varies, the household shows constant RRA. If a household decreases the percentage of risky assets in its portfolio with rising wealth, the household shows increasing RRA.[215]

The distinction between risk-free and risky assets, initially, might be perceived as puzzling since a literally risk-free asset does not exist in real-world financial markets. In this sense, Cohn et al. (1975) suggest to define those assets as risk-free whose provided stream of benefits is regarded as free of relevant uncertainty by the household when deciding on its portfolio. This thesis follows this approach. Hence, the necessary classification of the analyzed asset classes in risky and risk-free assets requires a case-sensitive assessment in the context of the research question.

Moreover, the distinction between risk-free and risky assets traces back to the Tobin-Separation. Due to the inexistence of the market portfolio as investment opportunity for households, households' actual financial risk-taking may be more accurately assessed by the portfolios' return variability than by the portfolios' risky asset share.

Besides the classification of the asset classes' riskiness, the wealth measure is a frequently discussed topic due to necessary assumptions on how to proxy for the relevant wealth measure.[216] Paya/Wang (2016) find evidence for each type of RRA in the cross section of one dataset depending on the wealth measure they use. This finding indicates that different approaches to measure households' wealth might be one explanation for the ambiguous findings regarding households' RRA.[217] While Pratt (1964), Arrow (1971), and Siegel/Hoban Jr. (1982) find evidence for increasing relative risk aversion, findings of Friend/Blume (1975), Brunnermeier/Nagel (2008), and Chiappori/Paiella (2011) indicate constant RRA, whereas the analyses of Cohn et al. (1975), Morin/Suarez (1983), Riley/Chow (1992), Oehler (1998), Calvet/Sodini (2014), and Oehler/Horn/Wedlich (2017) favor decreasing RRA.

[215] See Cohn et al. (1975), Oehler (1995), pp. 105 ff., Oehler (1998).
[216] See Guiso/Sodini (2013), p.1430, Siegel/Hoban Jr. (1991).
[217] See also Siegel/Hoban Jr. (1991).

However, the measures ARA and RRA are just the outcome of households' portfolio choice.[218] Since households' portfolio choice is influenced by their limited cognitive capacity and the necessity to use heuristics and rules of thumb (see Section 2.5), it is doubtful that households' portfolio choice exactly reflects households' risk attitude.[219] Nosic/Weber (2010) formulate the financial risk taken by households as a function of households' risk attitude, the perceived return of the investment, and households' financial risk perception. This thesis follows this line of argument and handles households' ARA and RRA as outcomes of the portfolio choice, while households' risk attitude measured with the subjective question from Section 3.1.3.2.1 is considered as determinant for households' portfolio choice.

3.2 Personal Situation

3.2.1 Gender

Recent studies using experimental settings, field data, and surveys frequently observe a statistically and economically significant link between investors' gender and investment policy[220]. Regarding the initial decision on which asset classes to include in the portfolio, Sunden/Surette (1998) show that men are more likely to use stock investments in their retirement saving plans than women. Kaustia/Luotonen (2016) find further support for this gender effect by analyzing investments of households included in the Survey of Health, Aging and Retirement in Europe (SHARE). According to their analysis, even among households which are both wealthy and highly educated, portfolios of male FKPs are four percentage points more likely to include stocks than portfolios of female FKPs.[221]

Studies analyzing the asset class weights of broker accounts, retirement savings plans, and household portfolios show that among those who decided to invest in stocks, men allocate a higher percentage of their portfolio in stocks than women.[222]

[218] See Oehler/Horn/Wedlich (2017).
[219] This could only be the case if households would be clones of the homo economicus.
[220] See Section 1.1 for the stylized process.
[221] See Kaustia/Luotonen (2016).
[222] See Agnew et al. (2003), Barber/Odean (2001), Dwyer et al. (2002), Halko et al. (2012).

However, men do not show better market timing or stock selection skills than women[223], but trade more excessively.[224]

Moreover, investors' overconfidence[225] and risk attitude are mediators of the influence of investors' gender on their portfolio choice. Since overconfident investors overestimate their future returns from risky investments, more overconfident investors hold riskier portfolios than less overconfident investors.[226] Due to the latter relation, males' higher overconfidence in the financial domain helps to explain why men hold riskier portfolios than women.[227] Furthermore, in experiments[228] and surveys[229], women show a higher degree of risk aversion (mostly assessed by the measures described in Section 3.1.3.2) than men.[230] Although investors' risk attitude and degree of overconfidence capture a considerable amount of the original gender effect's influence, investors' gender is still a significant explanatory factor regarding households' portfolio choice in the presence of other personal factors.[231]

3.2.2 Wealth and Income

Households have two main (financial) resources, tangible wealth and human capital.[232] Human capital is, from an economic point of view, determined by an individual's ability to earn labor income. Hence, human capital is equal to the value of the discounted cash flows from future labor income.[233] However, human capital is not tradable[234], or usable as collateral, which is why human capital can only be converted to tangible wealth as savings over the life cycle.[235]

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[223] See Barber/Odean (2001).
[224] See Agnew et al. (2003), Barber/Odean (2001), (2013), Choi et al. (2002), Dorn/Huberman (2005), Mitchell et al. (2006).
[225] In this context, overconfidence means that investors overestimate the precision of their personal information on the financial assets (see Odean (1998)).
[226] See Odean (1998).
[227] See Barber/Odean (2001).
[228] See Barsky et al. (1997), Bollen/Posavac (2018), Oehler/Horn/Wedlich (2017), Powell/Ansic (1997).
[229] See Booth/Katic (2013), Dohmen et al. (2011), Guiso/Paiella (2008), Hartog et al. (2002).
[230] See also the reviews of Croson/Gneezy (2009) and Eckel/Grossman (2008).
[231] See Kaustia/Luotonen (2016).
[232] See Guiso/Sodini (2013), p. 1403, Oehler (1995), p. 115.
[233] Within this thesis, pension payments from the governmental pension system and private pension plans are also considered as labor income.
[234] Possible exceptions are whole life insurances and private pension plans with the possibility to receive a one-off payment instead of lifelong pension payments.
[235] See Campbell (2006), Guiso/Sodini (2013), p. 1403.

While households' tangible wealth is principally fairly assessable by the market values of the respective assets, the value of the human capital underlies too many hardly predictable influences to be accurately assessable for both, households and researchers.[236] Instead, households' monthly income (which also captures income from pension payments) is commonly used as household-specific characteristic to proxy differences in households' human capital.[237] This thesis follows this approach.

Households' income and tangible wealth have been frequently included as determinants in studies that focus on at least one decision of households' investment policy, i.e. the selection of the included asset classes and/or the asset class weights. Regarding the initial decision on which asset classes to include in the portfolio, households with a higher monthly income are more likely to participate in stock markets.[238] Because of market entry barriers such as fixed participation costs[239], households' tangible wealth is positively correlated with the participation rate of households in stock markets and other risky assets such as real estate.[240]

Furthermore, households with higher income on average establish portfolios with higher weight on the risky asset classes.[241] Findings on the relation between households' tangible wealth and the risky asset share of their portfolio are rather ambiguous.[242] Empirical analyses reveal evidence of all kinds of possible relations: increasing[243], constant[244], and decreasing[245] proportions of the risky asset share with rising tangible wealth. Using the dataset of the US Survey of Income and Program Participation Riley/Chow (1992) find that the portfolio share of bonds tends to fall with both rising income and wealth, whereas real estate exhibits no clear pattern, and portfolio shares of stocks increase. The mixed findings of those analyses can be explained by various reasons.[246] First, the studies employ heterogeneous measures for households' tangible wealth. Second, some studies include human capital while

[236] See Guiso/Sodini (2013), p. 1403.
[237] See, e.g., Calvet et al. (2007), (2009b), Hackethal et al. (2012), Kaustia/Luotonen (2016), von Gaudecker (2015).
[238] See Haliassos/Bertaut (1995), Mankiw/Zeldes (1991), Kaustia/Luotonen (2016), Laurinaityte (2018).
[239] See Campbell (2006), Vissing-Jorgensen (2002), (2004).
[240] See Bilias et al. (2010), Calvet et al. (2007), Campbell (2006), Haliassos/Bertaut (1995), Kaustia/Luotonen (2016).
[241] See Calvet et al. (2007), Calvet/Sodini (2014), Laurinaityte (2018).
[242] See Guiso/Sodini (2013), p. 1433.
[243] See Calvet/Sodini (2014), Cohn et al. (1975), Morin/Suarez (1983), Oehler (1998), Riley/Chow (1992).
[244] See Brunnermeier/Nagel (2008), Chiappori/Paiella (2011), Friend/Blume (1975).
[245] See Arrow (1971), Pratt (1964), and Siegel/Hoban Jr. (1982).
[246] See Paya/Wang (2016).

other studies do not. Third, conditional on including human capital, estimation problems associated with the inclusion of human capital. Additionally, households may not adapt the weights of the risky asset classes in their portfolio uniformly in response of wealth changes.

In general, the extent of households' portfolio rebalancing strongly relies on the account that includes the risky assets. While households suffer from excessive trading in their brokerage accounts[247], households also show strong inertia in their pension accounts[248]. Nevertheless, households with higher income and tangible wealth are assumed to suffer less from inertia in financial risk-taking and from a disposition effect, i.e. holding losing and selling winning stocks.[249] Since, however, the vast majority of households is not able to outperform the market by using active trading strategies,[250] it is of interest whether households' capabilities of composing an efficient portfolio for a buy-and-hold strategy depend on households' income and/or wealth (see RQ3).

3.2.3 Age

Empirical studies provide evidence that households' willingness to take financial risks depends on the age of the households' financial decision maker. Yet, results on this relation are ambiguous. Halko et al. (2011) find an inverted U-shaped relationship between willingness to take risks and increasing age.[251] In the sample of Barsky et al. (1997) the ages 55 to 70 show a lower risk tolerance than younger and older age groups. Dohmen et al. (2011), (2017) find that the degree of risk aversion increases with age.

According to cross-sectional and longitudinal studies, households' stock market participation is U-shaped with respect to age. Furthermore, households' risky asset share stays relatively constant over time, even though, with the tendency to reduce the risky asset share with increasing age.[252]

[247] See Anderson (2005), Barber/Odean (2000), Bauer et al. (2007).
[248] See Agnew et al. (2003), Barber/Odean (2000), Bilias et al. (2010).
[249] See Barber/Odean (2013), Calvet et al. (2009a), (2009b), Dhar/Zhu (2006).
[250] See Sections 2.1 and 2.5.
[251] See also Josef et al. (2016).
[252] See Ameriks/Zeldes (2004), Bakshi/Chen (1994), Fagereng et al. (2017), Guiso/Sodini (2013), Palsson (1996).

However, little is known about an age-dependence of the efficiency of households' portfolios.[253] Findings of Campbell et al. (2014) and Nicolosi et al. (2009) suggest that trading experience enhances investors' investment performance. This finding is to some extent supported by Seru et al. (2010) but with the addition that a significant amount of investors who do not improve their trading performance over time stop trading after realizing their poor trading ability. In contrast, Calvet et al. (2009b) find a weak negative relation between the age of households' financial decision maker and the sophistication of the households' financial decisions. Korniotis/Kumar (2011) state that investment knowledge increases with age, however, this positive effect is dominated by adverse effects of cognitive aging which, overall, lead to worse investment skills with increasing age.

3.2.4 Graduation and Professional Qualification

In addition to the findings on the influence of households' socio-demographics and -economics, increasing evidence is provided that cognitive abilities (measured e.g. by graduation, qualification, or IQ) could play an important role in investment decisions. Dohmen et al. (2010) and Beauchamp et al. (2017) find that individuals with higher cognitive abilities show a higher willingness to take financial risks. As a consequence, investors with higher cognitive abilities also show a higher probability to participate in risky asset markets.[254]

In the subsample of those who invest in risky assets, higher cognitive abilities are associated with more favorable financial outcomes.[255] However, the latter findings on the predictive power regarding the influence of cognitive abilities on households' investment decisions need to be treated with caution. Findings of Kaustia/Luotonen (2016) suggest that differences in investors' IQ hardly affect portfolio choices after controlling for investors' risk attitude, albeit investors' education (i.e. their graduation and professional qualification) still provides additional explanatory power. As a consequence, investors' IQ can be omitted as influential factor regarding households'

[253] But survey-evidence in Oehler (2012e) shows that young adults are neither less interested in financial topics nor more reluctant to make financial precautions than older adults.
[254] See Beauchamp et al. (2017), Christelis et al. (2010), Cole et al. (2014), Grinblatt et al. (2011), (2012).
[255] See Cole et al. (2014), Grinblatt et al. (2012).

investment decisions if investors' risk attitude is included, whereas investors' graduation and professional qualification needs to be considered anyway.

4 Conceptual Foundations for the Empirical Analyses

4.1 Portfolio Selection Models

4.1.1 Mean-variance Portfolio Theory

According to Rubinstein (2002) the mean-variance portfolio theory (MVT) is commonplace to structure portfolios and measure their performance. It is established by Markowitz (1952) and based on the assumption that two objectives are common to all investors. First, every investor prefers a portfolio with higher return to a portfolio with lower return.[256] Second, investors prefer certainty to uncertainty in the sense that investors want the return of their portfolio to be stable.[257] Markowitz (1952) suggests operationalizing the latter objective by measuring the variance of the portfolio's return.[258]

Since "[t]he portfolio with maximum expected return is not necessarily the one with minimum variance"[259], the MVT is a portfolio selection model that helps investors choose the portfolio that maximizes their expected utility over a certain period of time out of the infinite number of possible portfolios. Briefly, the MVT proposes a two-step selection process. The first step is to eliminate all inefficient portfolios from the set of available portfolios. An inefficient portfolio "yields less return with greater uncertainty than does another available portfolio"[260] in a certain period of time. The remaining portfolios are called efficient portfolios. Hence, "a portfolio is efficient, if there are no other portfolios having the same expected return at a lower variance of returns. Moreover, a portfolio is efficient if no other portfolio has a higher expected return at the same risk of returns"[261].

The second step of portfolio selection is to choose the optimal portfolio for an investor out of the set of efficient portfolios. "The efficient set of portfolios is sometimes called

[256] Return may be defined differently for each investor. E.g. for some investors some non-monetary aspects such as the fulfillment of ecologically and socially responsible requirements may contribute to the return of an investment (see Oehler/Horn/Wendt (2018c), Oehler/Schalkowski/Wendt (2014)). In this thesis, however, return is solely determined by cash flows.

[257] See Markowitz (1959), p. 6.

[258] Although the approach of Markowitz (1952) is based on the variance of the portfolio's return, it is pointed out that "[i]f instead of variance the investor was concerned with standard error […] or with the coefficient of dispersion […] his choice would still lie in the set of efficient portfolios" (p. 89). In a later review of his work, Markowitz mentions "that standard deviation (rather than variance) is the intuitively meaningful measure of dispersion" (Markowitz (1999), p. 6). Therefore, this thesis follows the more widespread approach to measure a portfolio's risk by the standard deviation of the portfolio's returns σ.

[259] Markowitz (1952), p. 79.

[260] Markowitz (1959), p. 6.

[261] Lee et al (2010), p. 60. See also Perridon et al. (2009), p. 253, Sharpe et al. (1995), pp. 193 ff.

the efficient frontier because graphically [,in a diagram with the portfolios' variance of returns on the x-axis and the portfolios' return on the y-axis,] all the efficient portfolios lie on the boundary of the set of feasible portfolios that have the maximum return for a given level of risk"[262]. Since investors have different preferences regarding the investment's risk-return trade-off, each investor will consider a different portfolio to be *optimal*. However, each investor's preferences regarding the risk-return trade-off can be expressed by an investor-specific indifference curve that represents each investor's utility for a given risk-return trade-off. The investor-specific "optimal portfolio is represented by the point where an indifference curve is tangent to the efficient frontier"[263] (see Figure 3).

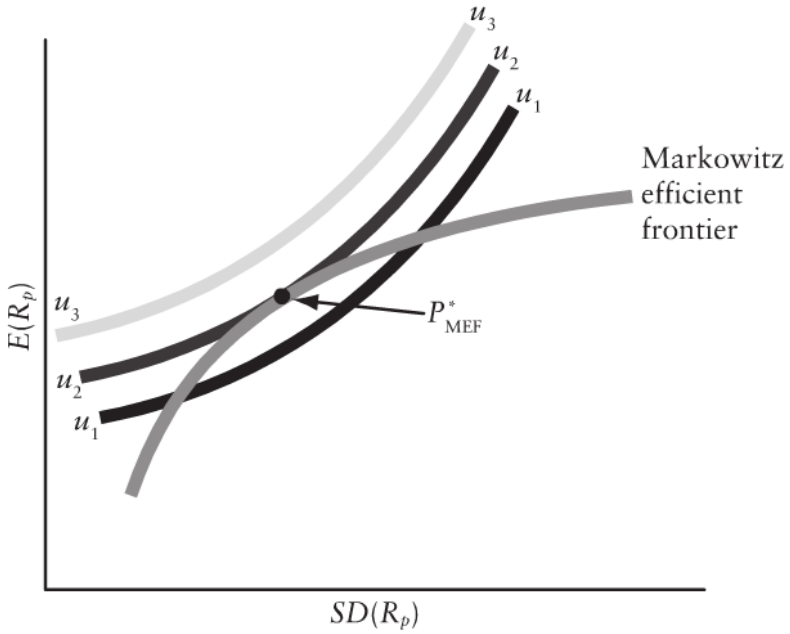

Figure 3: Selection of optimal portfolio in Mean-variance Portfolio Theory (Source: Fabozzi et al. (2011), p. 64)

Even if investors are not able to exactly identify their utility function – which is the case for almost all investors[264] – it is possible for them to select a portfolio which is

[262] Fabozzi et al. (2011), p. 63.
[263] Fabozzi et al. (2011), p. 63. See also Sharpe et al. (1995), pp. 196 f.
[264] See Fabozzi et al. (2011), p. 64.

very close to their utility maximizing portfolio by subjectively evaluating the return and risk characteristics of the portfolios on the efficient frontier.[265]

4.1.2 Consumption and Portfolio Choice Model of Merton (1969)

While the MVT solely focuses on selecting an optimal portfolio for a given amount of investment and over one period of time, it ignores that households must consider not only risks to their invested wealth, but also risks to the future conditions at which wealth can be reinvested.[266] Merton (1992) states that "[i]t is convenient to view the investment decision by households as having two parts:

(a) the "consumption-saving" choice where the individual decides how much income and wealth to allocate to current consumption and how much to save for future consumption; and

(b) the "portfolio-selection" choice where the investor decides how to allocate savings among the available investment opportunities"[267].

To also consider the consumption-saving choice, Merton (1969) develops a model where consumption and portfolio selection are treated as a combined problem. This means that an individual faces the decision to split up her wealth in two parts – one for consumption and one for investment. In contrast to the MVT, the consumption and portfolio choice model (CPCM) of Merton (1969) is designed as a continuous-time model, which means that both the consumption-saving choice and the portfolio-selection determine the wealth available for consumption and investment in the future, i.e. the subsequent consumption-saving and portfolio-selection choices. Moreover, the model comprises the concepts of absolute and relative risk aversion of Pratt (1964) and Arrow (1965)[268] and MVT (as a special case[269]).

Employing the assumption of constant relative risk aversion as well as the assumption that price changes of risky financial assets follow a Wiener process, the CPCM yields the implication that the share of wealth invested in risky assets solely

[265] See Levy/Markowitz (1979), Markowitz (1991).
[266] See Campbell (2006).
[267] Merton (1992), p. 13.
[268] See Section 3.1.3.2.2.
[269] See Merton (1982), p. 642.

depends on the investor's risk attitude as determined by the RRA measure of Pratt (1964) and Arrow (1965).[270] In other words, according to the CPCM ceteris paribus "all heterogeneity in observed portfolio shares should be explained by differences in risk attitudes, which are captured in the model by the relative risk aversion parameter"[271].

More specifically, households with low RRA choose low present consumption in order to invest a high share of their wealth in risky assets to attain higher future consumption by taking advantage of the risky assets' returns. In contrast, households with a high degree of RRA invest less in risky assets and instead enjoy higher present consumption.[272]

Applying the previous remarks to the first research aim and RQ1 and RQ2 of this thesis, the CPCM implies that a household's risky portfolio share ω_h is determined by the term

$$ln\omega_h = \eta lnW_h + \xi_h + \varepsilon_h \quad (1)$$

with

W_h as the wealth of household h;

η as the wealth elasticity of ω_h, where η=0 implies constant, η<0 increasing, and η>0 decreasing RRA;

ξ_h as a vector of the risk preferences and other (partially unobservable) characteristics (e.g. return and risk expectations) of household h.[273]

4.1.3 Behavioral Portfolio Theory

Although the portfolio choice models of Markowitz (1952) and Merton (1969) provide several appealing features, it is highly implausible that real-world households act

[270] See Merton (1969). Since the model of Merton (1969) is a neoclassical model, this implication is also driven by the assumption that all investors hold the market portfolio and have the same expectations regarding the risky assets' future risk and return (see Guiso/Sodini (2013), p. 1425). See Georgarakos (2014), p. 412 for studies that extend the model of Merton (1969) with observation and transaction costs.
[271] Guiso/Sodini (2013), p. 1425.
[272] See Merton (1969).
[273] See Guiso/Sodini (2013), p. 1433.

accordingly to the assumptions in these models.[274] To overcome the shortcomings associated with neoclassical normative models[275], Shefrin/Statman (2000) developed the Behavioral Portfolio Theory (BPT) as a positive portfolio model which does not rely on the concept of the homo economicus.

The BPT builds on the concepts of the safety-first portfolio theory[276], SP/A theory[277], and Prospect Theory[278] and incorporates households' mental accounting[279].[280] Furthermore, the BPT extends the relation between the consumption-saving and portfolio-selection choice by linking each mental account with a want and goal.[281]

Shefrin/Statman (2000) assume that households usually pursue more than one investment goal and, as a consequence, open more than one mental account. In dependence of the mental account's goal, the mental account is given an aspiration level ranging from low aspiration (e.g. to avoid poverty) to high aspiration (e.g. a shot at riches).[282] Subsequently, the mental accounts are prioritized by their aspiration level. Since the BPT is based on safety-first and SP/A theory, the accomplishment of the low aspiration goals has the highest priority. As a consequence, households will only then be willing to invest in risky assets if they reach a certain target value of wealth, e.g. for the purpose of avoiding financial ruin.[283]

According to the BPT, every mental account equals a portfolio of one or more assets. Households are assumed to design every portfolio for the purpose of reaching the goal associated with the respective mental account, while covariances among mental accounts are ignored.[284] Hence, the determinants of portfolio selection are the expected return of the portfolio (representing the return of the mental account) and the probability of failing to reach the threshold level of return, which is necessary to reach the goal associated with the mental account (representing the risk of the

[274] See Oehler (1995), (2004), (2011), (2012a), (2013c), (2013d), Oehler/Wendt (2017), Thaler (2016) on the divergence between real-world investors' behavior and the concept of the homo economicus.
[275] See, e.g., De Bondt et al. (2008), Oehler (1992), (1995), (2013c) on these shortcomings.
[276] See Roy (1952).
[277] See Lopes (1987).
[278] See Section 2.5.1.
[279] See Section 2.5.2.
[280] See Rengifo et al. (2014).
[281] See Shefrin/Statman (2000), Statman (2017), p. 176. After the publication of his portfolio theory, in 1952, Markowitz also pointed out the importance of linking portfolio analysis to investment goals by stating "[n]o single type of analysis is right for all purposes. The choice of analysis depends on the nature and goals of the investor." Markowitz (1959), p. 33.
[282] This implies the possibility of different utility functions in different mental accounts.
[283] Shefrin/Statman (2000).
[284] See Shefrin/Statman (2000).

mental account).[285] The latter measure of risk for households' portfolio choice, i.e. the probability of failing to reach the threshold level of return, represents a major difference between BPT and MVT.[286]

The different determinants of portfolio selection in BPT and MVT are accompanied by initially different understandings of portfolio efficiency.[287] While efficient portfolios in MVT "lie on the boundary of the set of feasible portfolios that have the maximum return for a given level of risk"[288], efficient portfolios in BPT lie on "an efficient frontier that reflects the trade-off between expected returns and the probability of failing to reach the threshold level of that mental account"[289]. In consequence, efficient portfolios in the sense of the BPT are not necessarily on the efficient frontier of MVT.[290]

However, Das et al. (2010) show that, generally, portfolios are efficient in both BPT and MVT when the BPT's trade-off between return and risk (i.e. the probability of failing to reach a threshold level) is treated as a value-at-risk type constraint and short selling is permitted. If short selling is not allowed, the efficiency loss is only a few basis points.[291] Using US stock price data, Pfiffelmann et al. (2016) show that at least 70 percent of the portfolios that are chosen by investors applying the BPT are also efficient when applying the MVT.

As implication for portfolio analysis, the insights of Das et al. (2010) provide the possibility to measure ex-post portfolio efficiency in a BPT framework by the portfolio's return and variance of returns (or likewise to the variance of returns also the standard deviation of returns).[292] The latter approach is employed in this thesis's portfolio analyses, i.e. ex-post portfolio efficiency is measured by a portfolio's return and standard deviation of returns, since households' threshold levels regarding their investment goals are not captured in available field data.

[285] See Das et al. (2010). See also Zeisberger (2016) for an investigation of loss probabilities as components of perceived risk.
[286] See Statman (2017), p. 176.
[287] See Rengifo et al. (2014) pp. 430 ff.
[288] Fabozzi et al. (2011), p. 63.
[289] Das et al. (2010), p. 312.
[290] See Shefrin/Statman (2000).
[291] See Das et al. (2010). Moreover, Levy et al. (2012) show that also the CAPM is intact in a Prospect Theory framework. Given the estimation risk regarding assets' expected risk, return, and covariances, the portfolio selection model of Das et al. (2010) leads to better performing portfolios ex-post than the approach of Markowitz (1952) (see Alexander et al. (2017)).
[292] See also Statman (2017), pp. 207 f.

4.2 Household Surveys as Data Source

According to Guiso/Sodini (2013), the enhanced data availability is a main driver of the rise of household finance, particularly since the first decade of the current century.[293] Data sources currently employed by researchers are household/consumer surveys[294], account/transaction data from brokerage houses[295], and administrative micro datasets[296] as well as combinations of them[297].[298]

The characteristics of an ideal dataset for positive household finance are summarized by Campbell (2006). First, the dataset has to cover a representative sample of the entire population. Second, the dataset includes both total wealth and an exhaustive breakdown of wealth into relevant categories, which are disaggregated to distinguish among asset classes. The dataset should additionally be reported with a high level of accuracy and contain panel data. Moreover, for this thesis's research aims it is essential that the dataset covers the determinants of households' investment decisions described in Chapter 3.

These requirements for an ideal dataset leave survey data as only suitable data source for this thesis, because data from brokerage houses usually cover only a snippet of the assets of a non-representative sample of households[299] while administrative micro datasets do not capture information about households' investment purposes, financial literacy and risk attitude[300].

Although most research on households' portfolio choice uses survey data[301], household surveys generally also have some weaknesses as data sources.[302] Most

[293] See Guiso/Sodini (2013), p. 1402. See also Badarinza et al. (2016).
[294] See e.g. Badarinza et al. (2016).
[295] See e.g. Barber/Odean (2000), Goetzmann/Kumar (2008).
[296] See e.g. Calvet et al. (2007) and Calvet/Sodini (2014).
[297] See e.g. Halko et al. (2012).
[298] See Badarinza et al. (2016). Further data sources for empirical research on the behavior of investors are data from observations, experiments, and content analysis. However, surveys are probably the most suitable and most common method for this thesis's intended type of analysis (see Oehler (1995), pp. 117 ff.).
[299] See Guiso/Sodini (2013), p. 1460.
[300] In addition, administrative datasets may also not include all assets of the households since some assets are likely to be held in other administrative institutions than the institution that provides the dataset (see Georgarakos (2014), p. 410).
[301] See Campbell (2006).
[302] For an overview see Groves (2004).

noticeably, surveys rely on the willingness of households to participate[303] and their ability/willingness to provide accurate answers.[304] Surveys can be performed as oral interviews or written survey; both may be supported by digital communication and advices.[305] Answers of the respondents in oral interviews may be influenced by the interviewer, while it is possible that (unobservable) third parties influence the answers of the respondents in a written survey.[306] Due to these weak points in the process of data acquisition, survey data is considered as being "notoriously inaccurate"[307].[308]

However, since the latter deficiencies are widely known, the data acquiring institutions work on methods to improve data accuracy. Meyer et al. (2015) recommend comparing survey results with administrative data to detect potential biases in the survey data. Furthermore, data editing and imputation methods are employed to enhance the consistency and accuracy of survey dataset.[309]

4.3 Assets in Household Portfolios

4.3.1 Households' Asset Allocation in Dependence of their Wealth

Household surveys in developed countries generally have the aim to capture households' balance sheets.[310] The studies of Arrondel et al. (2016) and Badarinza et al. (2016) provide an overview of mean/median households' balance sheets in the Euro Area, the United States, the United Kingdom, Canada, and Australia. They find that non-financial assets represent the major share of the average household's portfolio.[311] The two most valuable assets among households' non-financial assets are the *main residence* and *vehicles*.[312] Further non-financial assets are *other real estate and property*, *established businesses*, and *articles of great value* (including,

[303] Commonly the refusal rate is higher for more wealthy households (see Campbell (2006) and Guiso/Sodini (2013) p. 1460.
[304] See Campbell (2006), Oehler (1995), p. 122.
[305] See Oehler (1995), p. 121.
[306] See Oehler (1995), p. 122.
[307] Guiso/Sodini (2013), p. 1402.
[308] Meyer et al. (2015) show that the results for some items in US-surveys substantially differ from the respective results in administrative data.
[309] See von Kalckreuth et al. (2012).
[310] See Badarinza et al. (2016), Arrondel et al. (2016).
[311] See Arrondel et al. (2016).
[312] Since non-financial assets are often debt-financed, mortgage debt and vehicle loans in turn represent the largest positions on the liabilities side of households' balance sheet.

e.g., artifacts, antiques, jewelry).[313] The financial assets of the average household largely consist of *deposits and transaction accounts* as well as *retirement assets* and *life insurances*. On average, further financial assets such as *stocks*, *bonds*, and *mutual funds* only have a minor part.[314]

However, an *average household balance sheet* provides only little explanatory power, since both households' participation rate in asset classes and the share of the assets in relation to households' total wealth considerably change with household wealth.[315] Hence Arrondel et al. (2016) provide a more detailed picture of the balance sheets of households over the wealth distribution. Among households in the Euro Area, more than 94 percent of the households in the wealthiest quintile own their main residence. In contrast, only about five percent of the households in the quintile of the least wealthy are home owners.[316]

Arrondel et al. (2016) furthermore find that almost all households in the Euro Area own *deposits and transaction accounts*. The wealth held in *deposits and transaction accounts*, *retirement assets,* and *life insurances* rises with household wealth and typically exceeds the wealth invested in *stocks*, *bonds*, and *mutual funds*. The participation rate in *stocks*, *bonds*, and *mutual funds* strongly increases with household wealth. While only three percent of the households in the first wealthiest quintile hold the latter assets, the participation rate increases to 23 percent in the fourth and 44 percent in the fifth wealthiest quintile.[317]

These different participation rates depending on household wealth yield the following stylized facts about the asset allocation in household portfolios. Except for the households in the top quintile of the wealth distribution, the primary residence is the main form of wealth for the households which can afford it (sometimes also referred to as "crowding out effect"[318] of real estate).[319] For the households in the top quintile of the wealth distribution, the share of the main resident's value on household wealth substantially drops while the share of financial assets and *established businesses* on

[313] See Deutsche Bundesbank (2016).
[314] See Badarinza et al. (2016).
[315] See Arrondel et al. (2016) and Section 3.2.2.
[316] Campbell (2006) finds similiar patterns for households in the United States.
[317] See Arrondel et al. (2016).
[318] Cocco (2005), p. 335, see also Laurinaityte (2018).
[319] See Campbell (2006), Guiso/Sodini (2013), p. 1410.

household wealth increases.[320] The households which do not own their main residence allocate most of their wealth in vehicles and financial assets.[321] As a consequence, the share of financial assets on household wealth shows a u-shaped pattern over the household wealth quintiles.[322]

The allocation of financial assets also changes with their overall value. With rising value, households commonly hold a lower share of their financial assets in *deposits and transaction accounts* and a higher share in *stocks* and *bonds* (also indirectly through mutual funds).[323] However, the latter effect is less pronounced for households in the center of the wealth distribution.[324] The percentages of financial assets' value invested in *life insurances* and remaining financial assets are by and large independent of the financial assets' value and lower than the shares invested in *deposits and transaction accounts*, *stocks*, and *bonds*.[325]

In summary, it can be stated that the weights of the assets classes in households' portfolios hardly follow a strict monotonic function of households' wealth. The findings rather suggest that households – in dependence of their wealth – pursue different goals and only then pursue a further goal (e.g. a shot at riches with risky financial assets), when the previous one (e.g. owning the main resident as insurance against rising rents and as retirement saving) is reached. This behavior can hardly be explained with the CPCM but is in accordance with the assumptions of the BPT.

4.3.2 Households' Speculation-Portfolio

According to Oehler (2015d) and Oehler/Horn/Wendt/Reisch/Walker (2018), the speculation-portfolio of a German household includes the assets which are affordable for a household after its basic[326] and additional[327] financial needs have been

[320] See Bach et al. (2017), Campbell (2006), Guiso/Sodini (2013), p. 1410. The increasing share of financial assets and established businesses is considered the reason why the wealthier households earn higher average returns (see Bach et al. (2017), Benhabib et al. (2011)).
[321] See Campbell (2006), Guiso/Sodini (2013), p. 1410.
[322] See Guiso/Sodini (2013), p. 1412.
[323] See Calvet et al. (2007), Guiso/Sodini (2013), pp. 1413 ff., Oehler (1992), (1995), pp. 166 f.
[324] See Calvet et al. (2007).
[325] See Calvet et al. (2007), Guiso/Sodini (2013), pp. 1413 ff.
[326] Assets and products which cover basic financial needs are liquidity provisions (also considering unsecured debt such as consumer loans and credit card debts), health care, liability insurance and disability insurance (see Oehler (2015d), Oehler (2017c); see also Oehler/Stellpflug (2015) regarding existence-threatening financial risks).

covered. Applied to households' balance sheet as described in Chapter 4.3.1, the speculation-portfolio covers households' net wealth invested in the asset classes *deposits and transaction accounts* (from now on referred to as *money market*), *stocks* (also covering mutual stock funds), *bonds* (also covering mutual bond funds), *real estate funds*, and *other financial assets* that primarily have an investment character (e.g. money debt towards the household, certificates, etc.). For this thesis, the wealth held in *assets of great value* (e.g. bullion coins, collectables) is ascribed to the speculation-portfolio additionally. The reason for including *articles of great value* is that some of these articles can also be seen as financial assets, e.g. bullion coins are standardized assets with face values and legal tender status and their price is continuously settled on exchanges around the world.

Households' direct investments in real estates are not included in their speculation-portfolio. These investments are partially sponsored by the German government, since owning a house or apartment is considered as a conservative way of retirement saving; its purpose is not primarily to earn (book) returns.[328] As a consequence, mortgage loans are also not considered as part of the speculation-portfolio. Cars are not considered in the speculation-portfolio as well, because they are in most cases necessary for household members to commute and do not earn investment returns; one exception are antique cars if they were referred to as *article of great value*.

4.4 Data Sources for the Empirical Analyses

4.4.1 Deutsche Bundesbank's Panel on Household Finances Survey (PHF survey)

The empirical analyses of this thesis rely on data from the Panel on Household Finances Survey (PHF survey) (DOI: 10.12757/PHF.01.01.01.stata) performed and provided by the German central bank (Deutsche Bundesbank) as part of the European Household Finance and Consumption Survey (HFCS). More specifically, the analysis relies on the first wave of the PHF-Survey from 13th September 2010 to

[327] Assets and products which cover additional financial needs are retirement provisions and accident insurance (see Oehler (2015d), Oehler (2017c)).
[328] See Deutsche Bundesbank (2015).

18th July 2011.[329] Since data of the second wave of the PHF-Survey, which was carried out in 2014, was not accessible when this thesis's empirical analyses were started, only cross-sectional and no panel analyses are possible.

The interviews of the PHF-Survey are conducted by 212 trained interviewers as face-to-face, computer-aided personal interviews. The sampling design of the survey successfully led to an oversampling of wealthy households.[330] Besides this intended divergence, comparisons with external statistics show that the PHF dataset neither suffers from severe selectivity problems nor is it an unrepresentative sample of German households.[331]

The entire sample consists of 3,565 households. Although the exact date of the interview is not noted, for each household the quarter of the year in which the survey took place is indicated. For the empirical analyses of this thesis, it is assumed that all households were interviewed on the same day in the middle of one quarter, namely the 15th of November 2010 for households which were surveyed in the fourth quarter of 2010 and the 14th of February (16th of May) 2011 for households which were interviewed in the first (second) quarter of 2011. Households that were interviewed in September 2010 and July 2011 are excluded because of small sample size.

For each household, the PHF-Survey covers the absolute amount of money invested per asset class. Furthermore, the dataset, among others[332], includes the following information about the households'/FKPs' personal disposition (question and code of variable in parentheses).[333]

- Purpose for Saving[334] ("What are (your / your household's / the household's) most important reasons for saving?"; Multiple answers possible; DHI0300a-m)

[329] See von Kalckreuth et al. (2012).
[330] The oversampling of wealthy households was intended by Deutsche Bundesbank to better be able to analyze the composition and distribution of wealth (see Schmidt/Eisele (n.y.)). In contrast to comparable surveys, more wealthy households even showed a slightly higher participation rate than less wealthy households (see von Kalckreuth et al. (2012)).
[331] See von Kalckreuth et al. (2012).
[332] The selection of relevant items is based on the review in Section 3.1. As a consequence, not all variables of the PHF-Survey are employed, e.g. only the domain-specific question regarding households' risk attitude is used for the analysis.
[333] The items represent an excerpt from the detailed question program including all questions, variables, and their codes available at https://www.bundesbank.de/Navigation/EN/Bundesbank/Research/Panel_on_household_finances/User_documentation/user_documentation.html
[334] Since purpose of investing is not included, purpose of saving is considered as proxy.

- Make ends meet (“If you now think about the entire monthly income of (your / your / the) household, how well do you think (your / your / the) household makes ends meet? 1 – With great difficulty; 2 – With some difficulties; 3 – Fairly easily; 4 – Easily”; DHI0800)

- Personal information: Saving in the next 12 months (“If you now compare the next twelve months with the past two years: (will you / will your household / will the household) save a larger, smaller or approximately the same share of the household disposable income?”; HNI0700)

- Financial Literacy (“Let us assume that you have a balance of €100 on your savings account. This balance bears interest at a rate of 2% per year and you leave it for 5 years on this account. How high do you think your balance will be after 5 years?”; DHNM0100)

- Financial Literacy (“Let us assume that your savings account bears interest at a rate of 1% per year and the rate of inflation is 2% per year. Do you think that in one year's time the balance on your savings account will buy the same as, more than or less than today”; DHNM0200)

- Financial Literacy (“Do you agree with the following statement: "Investing in shares of one company is less risky than investing in a fund containing shares of similar companies"?”; DHNM0300)

- Risk Attitude (“Which of the statements in list 32 comes closest to describing the attitude to risk when your household makes savings or investment decisions?”/ ”Which of the statements in list 33 comes closest to describing your personal attitude to risk when making savings or investment decisions personally?”; HD1800/DHD2800[335])

with list 32 (list 33 is similar but does not include answer number 5):

1 – We take substantial financial risks expecting to earn substantial returns

2 – We take above-average financial risks expecting to earn above-average returns

3 – We take average financial risks expecting to earn average returns

[335] DHD2800 is only asked if the FKP states that it is not possible to ascribe a homogenous financial risk attitude to the household.

4 – We are not willing to take any financial risk

5 – No classification possible for the household as a whole

Households'/FKPs' personal situation is, among others[336], covered by the following items (question and code of variable in parentheses, if applicable).

- Gender

- Household total wealth ("How high would you say (your net wealth / the net wealth of your household / the net wealth of the household) is? The net wealth is the value of everything belonging to household members minus all liabilities. Please also take the assets in list 11 into consideration, and then subtract debts and liabilities."; DHI0700)

  with list 11:

  Real estate
  Vehicles
  Stocks in companies
  Financial assets
  Insurances
  minus debts and liabilities

- Monthly disposable household net income ("How high is (your household's / your household's / the household's) monthly disposable net income? This is the money that is available for spending after all taxes and social security contributions have been paid. Please consider the income types in list 9 in your answer."; DHI0600)

  with list 9:

  Salary
  Income from self-employed activities
  Pension

[336] The selection of relevant items is based on the review in Section 3.1.

Income from government assistance
Income from property leases
Leasing
Housing allowance
Child allowance
Other incomes

- Age

- Highest education level (“What is the highest level of education (you have / [Name] has) completed. Please refer to list 5.”; DPA0300)

with list 5:

1 – Still at school
2 – Completed lower secondary school
3 - Completed higher secondary school
4 – Completed East German standard school up to 10th grade
5 – University of applied sciences entrance diploma / completed technical school
6 – General or subject-specific university entrance diploma / senior school-leaving certificate (from a grammar school) / East German secondary school up to 12th grade (also with apprenticeship)
7 – Other
8 – No school-leaving qualification

- Highest level of professional education (“Have you / Has [Name]) completed a training qualification or course of study. In the event of more than one certificate, please only enter the highest achieved. Please refer to list 6.”; DPA0400)

with list 6:

1 – Currently in training or studying
2 – Yes, vocational training completed (apprenticeship)

3 – Yes, vocational training completed (vocational school or commercial college)

4 – Yes, training at a technical or commercial college, school for master craftsmen or engineers or university of cooperative education completed

5 – Yes, university of applied sciences degree

6 – Yes, university degree obtained / teacher training completed

7 – Yes, doctorate / postdoctoral qualification obtained

8 – Other

9 – No, no training completed

According to Deutsche Bundesbank, the items on households' total wealth and monthly disposable net income received "[s]pecial attention"[337] in the editing process after the interviews in which "a battery of logical consistency checks within each section and across different sections of the questionnaire was applied"[338]. Inaccuracy of the survey data should, therefore, be reduced as far as possible.

4.4.2 Benchmark Indices for Asset Classes

The performance of households' speculation-portfolios is determined by the returns and return variances of the asset classes included in the portfolio. The calculations of households' portfolio returns and the returns' standard deviation are based on a benchmark for each asset class.

The benchmark of the asset class *money market* is a weighted average interest rate calculated from data of Deutsche Bundesbank. The weighted average interest rate includes the interest rate for overnight money[339], deposits with maturities of up to two

[337] Le Blanc (n.y.), p. 7.
[338] Le Blanc (n.y.), p. 6.
[339] See the data series BBK01.SU0101 by Deutsche Bundesbank.

years[340], and deposits with maturities of over two years[341], weighted by the respective outstanding amounts of deposits[342].

Since households are hardly able to directly invest in an asset class index[343], ETFs and certificates on exchange traded indices are employed as benchmarks. Due to German households' home bias[344], German indices are selected for the asset classes *stocks* (also covering mutual stock funds), *real estate funds*, and *articles of great value*. Since liquid ETFs on a German bond index are missing, a European index is selected as benchmark for the asset class *bonds* (also covering mutual bond funds). The selection criterion for a certain ETF or certificate is its trading volume[345], i.e. the ETF or certificate with the highest trading volume is selected as benchmark. The reason for this choice is the intention to capture households' actual portfolio performance more accurately instead of providing an analysis that shows what households' portfolio performance would look like, if they invested in the indices closest to the neoclassical market portfolio. The selected benchmarks are presented in Table 1.

Table 1: Benchmarks of Asset Classes

Asset class	ISIN of ETF/Certificate	Underlying index
Stocks	DE0005933931	DAX30 Performance Index
Bonds	DE000A0RM447	Barclays Euro Aggregate Bond Index
Real estate funds	DE000VT0RLV8	Vontobel REITs Low Volatility Performance Index
Articles of great value	DE000DR0NUM1	Solactive Luxury and Lifestyle Index (Total Return)

Source: Oehler/Horn (2016)

No benchmark is assigned to the asset class *other financial assets* because of its wide range of different asset characteristics.

The development of the benchmarks is presented in Figure 4. All five benchmarks earned positive returns in the observation period. The highest annual returns of 17.6

[340] See the data series BBK01.SUD001 by Deutsche Bundesbank.
[341] See the data series BBK01.SUD002 by Deutsche Bundesbank.
[342] See the data series BBK01.OU5703, BBK01.SUD021, BBK01.SUD022 by Deutsche Bundesbank.
[343] See Section 2.4.
[344] See Oehler et al. (2007), Baltzer et al. (2015), and Section 2.5.3.
[345] The aggregated trading volume of ETFs and certificates on German stock exchanges is available at: https://www.comdirect.de/inf/etfs/meistgehandelt.html.

percent were achieved in the asset class *articles of great value*, where prices roughly doubled in the observation period; the lowest annual return of 1.2 percent was achieved by the asset class *money market*.

Figure 4: Returns of Benchmarks in Observation Period (Source: Horn (2018))

The correlations between the assets' daily returns are highlighted in Table 2. Returns of *bonds* and *money market* are hardly correlated with each other and the remaining benchmarks' returns in the analyzed time period. Such weak correlations are one key requirement for benefits from portfolio diversification and rebalancing strategies.[346]

Table 2: Correlation Coefficients (Pearson) of Benchmarks' Returns from November 12th 2010 to May 18th 2015 (Source: Horn (2018))

	Stocks	Bonds	Real estate funds	Articles of great value
Bonds	-.07**	1		
Real estate funds	.40***	.09***	1	
Articles of great value	.68***	-.08***	.49***	1
Money market	-.03	-.03	-.02	-.01

Notes: The symbols *** and ** denote statistical significance at the one- and five-percent level, respectively.

[346] See Pliska/Suzuki (2004) and Tokat/Wicas (2007).

5 The Explanatory Power of the CPCM and the BPT with respect to the Financial Risk Taken by Households' through Their Investment Policy[347]

5.1 Methodological Approach

Stepwise cross-sectional regression analysis with four model specifications are used for the purposes of assessing households' relative risk aversion (RRA) (see RQ1) and of comparing the explanatory power of the Consumption and Portfolio Choice Model (CPCM) by Merton (1969) and the Behavioral Portfolio Theory (BPT) with respect to the financial risk taken by households through their investment policy (see RQ2).

The CPCM suggests that the risky asset share of households' entire portfolios is determined by households' total wealth, risk preferences, and other (partially unobservable) characteristics (e.g. return and risk expectations).[348] At this point, it is unclear if - and if so, how – households' wealth also influences the risky share of households' speculation-portfolio. However, the inclusion of mental accounting and the preclusion of covariances between mental accounts in the BPT suggests that it is not households' total wealth but only the value of the speculation-portfolio itself which, if at all, may influence the investment policy of households' speculation-portfolio.

Although a portfolio' risky asset share is an ambiguously interpretable measure[349], it is hardly possible to calculate the standard deviation of the returns (σ) of households' entire portfolios[350]. Yet, for the speculation-portfolio of household h, σ can be computed over a period of time T ($\sigma_{h,T}$) with the benchmark indices presented in Section 4.4.2 as an additional risk-taking measure to the risky asset share ($PercentageRisky_{h,SP}$). $\sigma_{h,T}$ is computed as $\sigma_{h,3years}$ and $\sigma_{h,4years}$ over a three and four year investment period after the households had been interviewed in the PHF-Survey. Due to the absence of an appropriate benchmark, the asset class o*ther*

[347] This chapter and the referred appendices are substantially obtained from Oehler/Horn (2018).
[348] See Section 4.1.2, equation (1).
[349] Due to the absence of the neoclassical market portfolio as investment possibility, households' risky asset share cannot directly be translated in risk and return expectations. Consider, e.g., two households A and B with A holding 10 percent stocks and 40 percent bonds whereas B holding 40 percent stocks and 10 percent bonds. Both households have a risky share of 50 percent but a different portfolio risk σ.
[350] This is mainly due to the absence of market prices for all assets of households' entire portfolios.

assets is excluded from the calculations of the speculation-portfolios' σ and the sum of the remaining asset classes' percentages in the speculation-portfolio is normalized to 100 percent.

For the analysis of households' speculation-portfolios equation (1)[351] is adapted to:

$$ln\omega_{h,SP} = \eta lnW_{h,SP} + \xi_h + \varepsilon_h \qquad (1b)$$

with

$\omega_{h,SP}$ as either $PercentageRisky_{h,SP}$, or $\sigma_{h,3years}$, or $\sigma_{h,4years}$.

$W_{h,SP}$ as the value of household's speculation-portfolio.

ξ_h as a vector of the risk preferences and other (partially unobservable) characteristics (e.g. return and risk expectations) of household h.

Of the asset classes in the speculation-portfolio, *stocks*, *bonds*, *real estate funds*, *assets of great value*, and *other financial assets* are considered as being risky. The asset class *money market* is classified as risk-free.

The analysis that relies on the CPCM additionally covers – if applicable – the net value of the *main residence* and *other real estate and property*, *value of businesses ran by household members*, *direct investments in firms* that are not listed on a stock exchange, and wealth on *retirement assets* and *life insurances* as well as households' total debts. The *value of businesses ran by household members* and *direct investments in firms* that are not listed on a stock exchange are considered as risky investments.[352] However, *(owner-occupied) residential property*, *retirement assets,* and *life insurances* are not included as risky assets since most households' main motivation for an investment in those assets should be a long-term risk reduction, e.g. income hedging with a retirement savings account or insuring against increasing rents with residential property.[353]

[351] See Section 4.1.2

[352] See Paya/Wang (2016) for a similar approach.

[353] In Germany owner occupied residential property is considered as a conservative way of retirement saving and therefore partially sponsored by the government (see Deutsche Bundesbank (2015)).

The household specific characteristics ξ_h include age (Age_h), squared age (Age^2_h)[354], and gender ($Female_h$) of household's FKP, the monthly household income ($Income_h$), a dummy variable that indicates whether at least one child at the age of 16 or younger lives in the household ($Child_h$), and household's risk attitude ($RiskAtt_h$)[355]. The risk attitude is captured with a vector including two dummy variables. The first dummy indicates if a household states to take no financial risk and the second dummy denotes whether a household is willing to take above average financial risk for above average financial returns[356]. Therefore, households stating to be willing to take average financial risk serve as basis (omitted dummy) of the vector.

The first model specification implements the CPCM and builds on equation (1). The respective full linear regression model is written in equation (2a).

$$lnPercentageRisky_{h,CPCM} = \beta_0 + \eta lnTWealth_h + \beta_1 * Age_h + \beta_2 * Age^2{}_h + \beta_3 * Female_h + \beta_4 * lnIncome_h + \beta_5 * Child_h + \gamma_1 * RiskAtt_h + \varepsilon \quad (2a)$$

The remaining three model specifications implement the BPT and build on equation (1b). In this three model specifications the independent variable $W_{h,SP}$ is the value of households' speculation-portfolio ($ValueSP_h$). The three model specifications differ regarding their risk-taking measure $\omega_{h,SP}$ which is either implemented as the speculation-portfolio's risky asset share ($PercentageRisky_{h,SP}$), or as the ex-post σ of a household's speculation-portfolio in the three ($\sigma_{h,3years}$) and four years ($\sigma_{h,4years}$) after the interview . The full linear regression model for the BPT is written in equation (2b).

$$ln\omega_{h,SP} = \beta_0 + \eta lnValueSP_h + \beta_1 * Age_h + \beta_2 * Age^2{}_h + \beta_3 * Female_h + \beta_4 * lnIncome_h + \beta_5 * Child_h + \gamma_1 * RiskAtt_h + \varepsilon \quad (2b)$$

[354] For the purpose of accounting for non-linear effects of households' wealth in their life-cycle.
[355] This means that only households which provide a risk attitude in item HD1800 are considered for the analysis.
[356] This also includes households which state "We take substantial financial risks expecting to earn substantial returns". The reason for this pooling is the small number of households stating to be willing to take substantial risk.

with

$\omega_{h,SP}$ as either $PercentageRisky_{h,SP}$, or $\sigma_{h,3years}$, or $\sigma_{h,4years}$.

The regression models of equations (2a) and (2b) apply to the sample of households that are wealthy enough to establish a speculation-portfolio with a value of at least 1,000 EUR[357], however, not considering whether the household invests in risky assets or not. First, the regression models are employed in a logit regression analysis to analyze households' decision to generally invest in risky assets in the context of the CPCM and the BPT. For this purpose, the dependent variable in equations (2a) and (2b) is replaced by a dummy variable that takes the value 1 if a household invests in risky assets and 0 otherwise. Second, the regression models of equations (2a) and (2b) are employed in a linear OLS regression. If a household does not hold any risky assets, $\ln\omega_h$ is set to -8.1 (which is equal to less than 1 EUR invested in risky assets) to avoid missing values for the full sample analyses.

Furthermore, robustness checks that extract the influence of households' purpose for saving, education and financial literacy, and the point in time when the interview took place are provided. In addition, the subsample of households that actually hold risky assets is further analyzed to estimate to which extent the explanatory power of the models primarily emerges from households' decision to invest/not to invest in risky assets.

Although the concept of RRA is originally based on investors' behavior in continuous time[358], this analysis, as most previous studies, uses cross-sectional data. In this case, the inclusion of households' risk attitude as explanatory variable for their RRA is based on the assumption that households' risk attitude is time invariant. This assumption is supported by experimental findings of Harrison et al. (2005), Sahm (2012), Weber et al. (2013), and Wölbert/Riedl (2013).

[357] See, e.g. von Gaudecker (2015) who uses this threshold.
[358] See Oehler (1995), p. 111.

5.2 Results

5.2.1 Descriptive statistics

Of 3,565 households in the sample of the PHF-Survey 1,401 answered the items required for the regression analyses and are wealthy enough to establish a speculation-portfolio with a value of at least 1,000 EUR.[359] The mean age of these households' FKPs is 58 years (median age: 59 years). 64 percent of the FKPs are male. In 18 percent of all households, there is at least one child who is 16 years of age or younger.

Table 3 contains descriptive statistics of the 1,401 households' risk-taking and wealth. In the framework of the CPCM, on average, the households invest 12.6 percent of their total wealth in risky assets. When implementing the BPT, the households invest 23.2 percent of their speculation-portfolio's value in risky assets. The moderate participation rate in risky assets is the reason why the mean standard deviation of the returns of households' speculation-portfolio is relatively low with a figure of 3.6 percent for the four year investment period. On average, the households' mean total wealth amounts to 472,369 EUR, while the mean value of the speculation-portfolio is 122,125 EUR. The median values are lower for all measures indicating a right-skewed distribution of the measures in the cross-section.

[359] Such a reduction of the sample size is not uncommon, e.g. Chatterjee et al. (2017) state that three out of five households in the US do not have any emergency funds set aside.

Table 3: Descriptive statistics of the risk-taking and wealth measures (N=1401 households)

Panel A: Risk-taking measures			
	Mean	Med.	Std.
$PercentageRisky_{h,CPCM}$	.126	.013	.234
$PercentageRisky_{h,SP}$	.232	.045	.302
Consisting of:			
Stocks	.103	.000	.202
Bonds	.056	.000	.148
Real Estate Funds	.017	.000	.074
Articles of Great Value	.057	.000	.153
$\sigma_{h,3years}$	.037	.007	.053
$\sigma_{h,4years}$	.036	.007	.051
Panel B: Wealth measures (in EUR)			
	Mean	Med.	Std.
$TWealth_h$	472,369	250,000	872,577
$ValueSP_h$	122,125	38,310	379,150

Notes: Panel A displays descriptive statistics of the risk-taking measures and Panel B of the wealth measures. For each measure the mean value (Mean), median value (Med.), and standard deviation (Std.) are provided.

5.2.2 Regression analyses

Stepwise logit regression analyses using the models from equation (2a) and (2b) are performed to analyze the relation between households' wealth and households' decision to generally engage in risky investments within the CPCM as well as the BPT. As first step of the regression analyses, the explanatory power of households' characteristics ξ_h is determined for each model specification. Thereafter, the explanatory power added when households' total wealth and the value of households' speculation-portfolio is included in the regression model are compared.

The results of the logit regression are presented in Table 4. The regression analyses reveal that the models correctly predict whether households invest/do not invest in risky assets in more than 70 percent of the cases. By just using the household-specific characteristics in the CPCM it is possible to correctly forecast whether a household invests in risky assets in 71.7 percent of all cases. Adding households' total wealth ($TWealth_h$) as explanatory variable increases the percentage of correct forecasts to 73.2 percent. Using the value of households' speculation-portfolio ($ValueSP_h$) in combination with the set of household specific characteristics as independent variables in the BPT model it is possible to correctly forecast 76.4 percent of the households that do not invest in risky assets and 78 percent of the households that invest in risky assets, leading to 77.2 percent of correct estimates

overall. This means that the forecasting probabilities in the BPT model are 4 percentage points higher than in the CPCM. The regression coefficients for households' total wealth and the value of households' speculation-portfolio show that, in general, households are more likely to invest in risky assets as they get wealthier in both models. Nevertheless, adding the value of households' speculation-portfolio as explanatory variable leads to a larger increase of the models' correct estimates than adding households' total wealth. This indicates that the value of households' speculation-portfolio is more influential than households' total wealth when households make the decision to generally invest in risky assets.

Table 4: Logit regression analyses with a dummy indicating investment in risky assets as dependent variable

	CPCM (model 2a)		BPT (model 2b)	
$lnTWealth_h$		.410*** (.058)		
$lnValueSP_h$				.914*** (.068)
ξ_h	Yes	Yes	Yes	Yes
β_0	-14.17*** (1.323)	-13.63*** (1.324)	-12.95*** (1.449)	-16.02*** (1.449)
2-Log-Likelihood	1541	1459	1574	1337
Nagelkerkes R^2	.318	.360	.306	.466
Percentage of correctly estimated non-risky investors	65.3	63.8	70.1	76.4
Percentage of correctly estimated risky investors	76.6	80.4	71.9	78.0
Percentage correct estimates	71.7	73.2	71.0	77.2
N	1401	1401	1401	1401

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), 2-Log-Likelihood statistics, Nagelkerkes R^2, and the percentage of correct estimates for the logit regression analyses using the regression models (2a) and (2b). ξ_h captures age (Age_h), squared age ($Age^2{}_h$), and gender ($Female_h$) of household's FKP, the monthly household income ($Income_h$), households' directly queried risk attitude ($RiskAtt_h$), and a dummy variable that indicates whether at least one child at the age of 16 or younger lives in the household ($Child_h$). The symbol *** denotes statistical significance at the one-percent level. Example: Regressing the risky asset dummy on regression model (2b) with $ValueSP_h$as wealth measure yields a coefficient of $ValueSP_h$ of .914 with a statistical significance at the one-percent level and a Nagelkerkes R^2 of .466.

Findings of the stepwise linear OLS regression analyses using the models from equation (2a) and (2b) are provided in Table 5. The dependent variables are

$PercentageRisky_{h,CPCM}$, $PercentageRisky_{h,SP}$, $\sigma_{h,3years}$, and $\sigma_{h,4years}$, respectively. Solely including the household-specific characteristics ξ_h without a wealth measure in the linear regressions already yields an adjusted R-squared of 24 to 26 percentage points in all four model specifications. This means that households' characteristics explain a very similar percentage of the financial risk taken by households through their investment policy in both the CPCM and the BPT models. Adding households' total wealth as independent variable in the CPCM model increases the adjusted R-squared by 0.9 percentage points. In contrast, introducing the value of households' speculation-portfolio provides an at least 9.4 percentage points higher adjusted R-squared in the BPT models. Consequently, the explanatory power – measured as the model's adjusted R-squared – of the BPT model, is at least 7 percentage points higher than the explanatory power of the CPCM. Moreover, the value of the speculation-portfolio explains the risky asset share of households' speculation-portfolio in the BPT model more accurately than households' total wealth explains the risky asset share of households' entire portfolio in the CPCM model. The explanatory power of the models with the speculation-portfolio's σ as dependent variable is very similar to the explanatory power of the models with the speculation-portfolio's risky asset share as dependent variable. The concept of decreasing RRA is supported in all model specifications.

Table 5: Stepwise regression analyses with $PercentageRisky_{h,CPCM}$, $PercentageRisky_{h,SP}$, $\sigma_{h,3years}$, and $\sigma_{h,4years}$ as dependent variable

Framework	CPCM (model 2a)		BPT (model 2b)					
Dependent variable $\omega_h/\omega_{h,l}$	$PercentageRisky_{h,CPCM}$		$PercentageRisky_{h,SP}$		$\sigma_{h,3years}$		$\sigma_{h,4years}$	
$lnTWealth_h$		.235*** (.060)						
$lnValueSP_h$				.983*** (.065)		.681*** (.048)		.679*** (.048)
ξ_h	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
β_0	-20.38*** (1.309)	-20.46*** (1.307)	-21.07*** (1.53)	-21.46*** (1.417)	-17.61*** (1.135)	-17.88*** (1.063)	-17.58*** (1.131)	-17.85*** (1.059)
R^2	.260	.269	.244	.352	.247	.341	.247	.341
R^2 adj.	.256	.265	.241	.349	.243	.337	.243	.337
F-Test	69.86	63.34	64.34	94.66	65.25	89.91	65.29	90.03
N	1401	1401	1401	1401	1401	1401	1401	1401

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R^2, adjusted R^2 (R^2 adj.), and F-statistics (F-Test) for the linear regression analyses using the models of equation (2a) and (2b). ξ_h captures age (Age_h), squared age ($Age^2{}_h$), and gender ($Female_h$) of household's FKP, the monthly household income ($Income_h$), households' directly queried risk attitude ($RiskAtt_h$), and a dummy variable that indicates whether at least one child at the age of 16 or younger lives in the household ($Child_h$). The symbol *** denotes statistical significance at the one-percent level. Example: Regressing $PercentageRisky_{h,SP}$ on the regression model with $ValueSP_h$ as wealth measure yields a coefficient of $ValueSP_h$ of .983 with a statistical significance at the one-percent level and an adjusted R^2 of .349.

So far, the findings show that linear regression models based on the BPT provide more explanatory power regarding households' RRA in the speculation-portfolio than linear regression models based on the CPCM regarding households' RRA in the entire portfolio. Moreover, the stepwise approach reveals that the wealth measure in the BPT model, i.e. the value of households' speculation-portfolio, adds more explanatory power on top of the household-specific characteristics than households' total wealth in the CPCM model. However, results in both frameworks are in favor of a decreasing RRA among households. More specifically, in both models households are more likely to generally invest in risky assets when they get wealthier. Furthermore, households' risky asset share and the σ of households' speculation-portfolio rise with wealth.

5.2.3 Robustness Checks

Previous studies identified an influence of investors' graduation and professional qualification[360] and financial literacy[361] on the probability of stock market participation and a relation between households' goal-based saving behavior and risk-tolerance[362]. ANOVA analyses are provided to figure out if and how these factors influence the risky asset share and σ of the household portfolios. The p-values of the ANOVA analyses are presented in Table 6 and show statistically significant differences regarding the risky asset share and σ of the portfolios among households with differently educated FKPs. Descriptive statistics of households' risky asset share and σ subdivided by the graduation and professional qualification of their FKPs[363] illustrate that financial risk taken by households through their investment policy increases with the education level of their FKP. Moreover, FKPs with different financial literacy build portfolios with different risky asset share and σ. However, a distinct relation between financial literacy and the financial risk taken by households through their investment policy cannot be observed. Instead, the risky asset share and σ of households that answered one or two questions in the way that Lusardi/Mitchell (2006) define as correct vary with no clear tendency. Those households that gave three – in the sense of the questions' authors – correct answers clearly have the highest risky asset share and σ. Furthermore, households saving for their own retirement show a slightly higher risky asset share and σ than households that save for larger purchases, emergency situations, or to support their children or grandchildren. The latter difference, however, is hardly statistically significant.

[360] See Section 3.2.4.
[361] See Section 3.1.2.
[362] See Section 3.1.3.2.1.
[363] These statistics are not reported in detail since the following regression analyses show that only few of the factors remain significant when households' wealth is considered.

Table 6: ANOVA graduation, professional qualification and purpose for saving

	p-values			
	Graduation	Professional qualification	Financial literacy	Purpose for saving
$PercentageRisky_{h,CPCM}$	.000	.000	.000	.087
$PercentageRisky_{h,SP}$	.000	.000	.000	.036
$\sigma_{h,4years}$	.000	.000	.000	.093

Notes: The table provides p-values for between group ANOVAs that analyze the influence of the graduation, professional qualification, and financial literacy of households' FKP as well as household's purpose for saving on the differences regarding households' $PercentageRisky_{h,CPCM}$, $PercentageRisky_{h,SP}$, and $\sigma_{h,4years}$. Regarding graduation the groups "lower secondary school", "higher secondary school", "university of applied sciences entrance diploma", and "general university entrance diploma" are considered. Regarding professional qualification the groups "no training completed", "currently in training/studying", "vocational training completed", "training at technical/commercial college completed", "university of applied sciences degree", "university degree", "doctorate/postdoctoral qualification" are considered. Regarding purposes for saving the groups "larger purchase excl. vehicles", "funds for emergency situations", "old-age provision", and "supporting children or grandchildren" are considered. For example, the p-value of .000 shows that there is a statistically significant difference (at least at the 99.9-percent level) regarding the mean values of $PercentageRisky_{h,CPCM}$ between the groups with different graduation.

Given the statistically significant different financial risk taken by households with different graduation, professional qualification, and financial literacy the linear regression models (2a) and (2b) are extended by these three factors. Graduation ($Graduation_{FKP,h}$) and professional qualification ($ProfessionalQual_{FKP,h}$) are included as ordinal factors. Financial literacy is captured by a dummy variable that is 1, if all three questions are answered correctly and 0 otherwise ($AllFinLit_h$). The full regression models are as follows:

$$lnPercentageRisky_{h,CPCM} = \beta_0 + \eta lnTWealth_h + \beta_1 * Age_h + \beta_2 * Age^2{}_h + \beta_3 * Female_h + \beta_4 * lnIncome_h + \beta_5 * Child_h + \beta_6 * Graduation_{FKP,h} + \beta_7 * ProfessionalQual_{FKP,h} + \beta_8 * AllFinLit_h + \gamma_1 * RiskAtt_h + \varepsilon \quad (3a)$$

$$ln\omega_{h,SP} = \beta_0 + \eta lnValueSP_h + \beta_1 * Age_h + \beta_2 * Age^2{}_h + \beta_3 * Female_h + \beta_4 * lnIncome_h + \beta_5 * Child_h + \beta_6 * Graduation_{FKP,h} + \beta_7 * ProfessionalQual_{FKP,h} + \beta_8 * AllFinLit_h + \gamma_1 * RiskAtt_h + \varepsilon \quad (3b)$$

A logit regression analysis is performed to check if the previous findings on households' decision to generally participate in risky assets are robust to the three control variables. The outcome of the logit regression analysis is presented in Table 7. FKPs' graduation and financial literacy are identified as statistically significant factors of influence regarding the decision to invest in risky assets in both the CPCM and the BPT model. Nevertheless, both models' fit still increases when the wealth measures are added. And again, the full model of the BPT provides a higher percentage of correct estimates and a higher explanatory power than the CPCM model. Compared to the previous logit regression (see Table 4), the three new factors hardly impact the models' accuracy. Therefore, the previous findings stay robust.

Table 7: Logit regression analyses with a dummy indicating investment in risky assets as dependent variable

	CPCM (model 3a)		BPT (model 3b)	
$lnTWealth_h$		.414*** (.060)		
$lnValueSP_h$				.883*** (.070)
$Graduation_{FKP,h}$	.258*** (.076)	.263*** (.079)	.267*** (.076)	.216*** (.083)
$ProfessionalQual_{FKP,h}$	.019 (.062)	.023 (.064)	.025 (.061)	-.012 (.067)
$AllFinLit_h$	.400*** (.146)	.467*** (.151)	.386*** (.145)	.483*** (.159)
Further households-specific characteristics ξ_h	Yes	Yes	Yes	Yes
β_0	-13.02*** (1.371)	-13.91*** (1.423)	-11.69*** (1.340)	-15.10*** (1.514)
2-Log-Likelihood	1447	1364	1478	1270
Nagelkerkes R^2	.339	.382	.329	.473
Percentage of correctly estimated non-risky investors	64.4	65.4	69.2	75.2
Percentage of correctly estimated risky investors	77.4	79.2	74.1	77.9
Percentage correct estimates	71.8	73.4	71.8	76.7
N	1345	1345	1345	1345

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), 2-Log-Likelihood statistics, Nagelkerkes R^2, and the percentage of correct estimates for the logit regression analyses using equations (3a) and (3b). ξ_h captures age (Age_h), squared age ($Age^2{}_h$), and gender ($Female_h$) of household's FKP, the monthly household income ($Income_h$), households' directly queried risk attitude ($RiskAtt_h$), and a dummy variable that indicates whether at least one child at the age of 16 or younger lives in the household ($Child_h$). $ProfessionalQual_h$ captures the professional qualification of the FKP in household h and $AllFinLit_h$ indicates whether household h answered all three financial literacy questions correct. The symbol *** denotes statistical significance at the one-percent level. Example: Regressing the risky asset dummy on regression model (3b) with $ValueSP_h$ as wealth measure yields a coefficient of $ValueSP_h$ of .883 with a statistical significance at the one-percent level and a Nagelkerkes R^2 of .473.

In addition, results of linear OLS regression analysis using models (3a) and (3b) are provided in Table 8. Again, the three additional factors graduation, professional qualification, and financial literacy provide only little further explanatory power. Compared to the previous linear regression analyses (see Table 5) the R-squared and adjusted R-squared rise between 0.9 and 2.3 percentage points. FKPs' graduation and financial literacy are both statistically significant factors. However, the regression coefficients of the wealth measures as well as their statistical significance hardly change compared to the previous analyses and are, therefore, robust to the

control variables. Once more, the explanatory power of the models with the risk-taking measures $PercentageRisky_{h,SP}$, $\sigma_{h,3years}$, and $\sigma_{h,4years}$ is very similar. Additionally, the full models based on the BPT still provide more explanatory power than the full model of the CPCM.

Table 8: Stepwise regression analyses with $PercentageRisky_{h,CPCM}$, $PercentageRisky_{h,SP}$, $\sigma_{h,3years}$, and $\sigma_{h,4years}$ as dependent variable

Framework	CPCM (model 3a)		BPT (model 3b)					
Dependent variable $\omega_h/\omega_{h,l}$	$PercentageRisky_{h,CPCM}$		$PercentageRisky_{h,SP}$		$\sigma_{h,3years}$		$\sigma_{h,4years}$	
$lnTWealth_h$		.216*** (.061)						
$lnValueSP_h$				.929*** (.066)		.640*** (.050)		.638*** (.049)
$Graduation_{FKP,h}$	.247*** (.086)	.247*** (.086)	.417*** (.100)	.321*** (.094)	.299*** (.074)	.233*** (.070)	.299*** (.074)	.233*** (.070)
$ProfessionalQual_{FKP,h}$	.086 (.067)	.086 (.068)	.041 (.079)	-.014 (.074)	.033 (.058)	-.005 (.055)	.033 (.058)	-.005 (.055)
$AllFinLit_h$	.601*** (.164)	.624*** (.165)	.602*** (.192)	.639*** (.179)	.453*** (.142)	.478*** (.134)	.448*** (.142)	.473*** (.134)
Further households-specific characteristics ξ_h	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
β_0	-18.91*** (1.368)	-18.98*** (1.366)	-19.57*** (1.596)	-20.52*** (1.491)	-16.45*** (1.185)	-17.11*** (1.119)	-16.43*** (1.181)	-17.08*** (1.115)
R^2	.282	.291	.269	.364	.271	.352	.271	.352
R^2 adj.	.276	.285	.264	.358	.266	.347	.266	.347
F-Test	52.27	49.14	49.15	69.25	49.60	65.86	49.61	65.90
N	1345	1345	1345	1345	1345	1345	1345	1345

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R^2, adjusted R^2 (R^2 adj.), and F-statistics (F-Test) for the linear regression analysis using the regression models (3a) and (3b). ξ_h captures age (Age_h), squared age ($Age^2{}_h$), and gender ($Female_h$) of household's FKP, the monthly household income ($Income_h$), households' directly queried risk attitude ($RiskAtt_{FKP,h}$), and a dummy variable that indicates whether at least one child at the age of 16 or younger lives in the household ($Child_h$). $ProfessionalQual_h$ captures the professional qualification of the FKP in household h and $AllFinLit_h$ indicates whether household h answered all three financial literacy questions correct. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing $PercentageRisky_{h,SP}$ on the regression model (3b) with $ValueSP_h$ as wealth measure yields a coefficient of $ValueSP_h$ of .929 with a statistical significance at the one-percent level and an adjusted R^2 of .358.

Since data of the PHF-survey were collected over an 11-month period, the previous results are controlled for a possible influence of the date of the interview. For this purpose, the dataset is subdivided accordingly to the quarter when households were

interviewed.[364] Again, the stepwise regression analyses reveal that the models based on the BPT provide more explanatory power regarding the relation between households' wealth and financial risk taken through their investment policy than the model based on the CPCM. Furthermore, models that use the risky asset share and the σ of the speculation-portfolio as risk-taking measure show similar explanatory power. The concept of decreasing RRA is supported in all models. Therefore, the main findings are also robust to the point in time when the survey took place.

Only half of the households that are wealthy enough to establish a speculation-portfolio with a value of at least 1,000 EUR actually invest in risky assets. This might entail a substantial part of the previous regression analyses' explanatory power coming from the subsample of households with no risky investments. To address this issue, the following analysis focuses on the subsamples of households that actually own risky assets. These subsamples cover 787 households for the analysis based on the CPCM and 736 households for the analysis based on the BPT. The difference between the numbers of households equals the number of households that solely have *businesses ran by household members* and *direct investments in firms* as risky assets. Compared to the full sample, households in these subsamples are on average wealthier. The 787 households in the subsample of the analysis based on the CPCM show a mean (median) total wealth of 644,545 EUR (367,000 EUR) and the speculation-portfolios of the 736 households of the BPT sample show a mean (median) value of 203,703 EUR (76,050 EUR).

Linear regression analyses are performed to assess the relation between these households' wealth and the financial risk taken by households through their investment policy. The respective results are presented in Table 9. Compared to the previous analysis the explanatory power of both models – measured by the adjusted R-squared of their regression models – considerably decreases by 16 to 31 percentage points depending on the model specification. More specifically, the full model of the CPCM provides an adjusted R-squared of 12.4 percent while the adjusted R-squared of the full models based on the BPT range between 4.5 and 6.1 percent. Furthermore, the relation between households' wealth and their risky asset share and σ change to the opposite. In the CPCM model, households' total wealth is

[364] See Appendix A for the detailed results of these regression analyses.

negatively correlated with households' risky asset share with a statistical significance at the one-percent level. The same holds true for the models based on the BPT when the financial risk taken by households through their investment policy is measured by the speculation-portfolio's σ. In the BPT models, however, a considerable amount of the regression models' explanatory power arises from households' directly queried risk attitude. Households stating to be willing to take above average risk show a higher percentage of risky investments and have speculation-portfolios with a higher σ than households stating to take average or no financial risk. Likewise, households stating not to be willing to take financial risk have portfolios with a lower share of risky assets and have speculation-portfolios with a lower σ than the remaining households.

Table 9: Stepwise regression analyses with $PercentageRisky_{h,CPCM}$, $PercentageRisky_{h,SP}$, $\sigma_{h,3years}$, and $\sigma_{h,4years}$ as dependent variable, conditional on holding risky assets

Framework	CPCM (model 3a)		BPT (model 3b)					
Dependent variable $\omega_h/\omega_{h,I}$	$PercentageRisky_{h,CPCM}$		$PercentageRisky_{h,SP}$		$\sigma_{h,3years}$		$\sigma_{h,4years}$	
$lnTWealth_h$		-.391***						
		(.054)						
$lnValueSP_h$				-.046		-.107***		-.107***
				(.035)		(.036)		(.036)
$AboveAverageRisk_h$	.467*	.466*	.467***	.474***	.693***	.709***	.687***	.703***
	(.272)	(.238)	(.176)	(.176)	(.182)	(.181)	(.180)	(.179)
$NoRisk_h$	-.577***	-.610***	-.267***	-.285***	-.273***	-.315***	-.273***	-.315***
	(.121)	(.117)	(.081)	(.082)	(.083)	(.084)	(.082)	(.083)
$Graduation_{FKP,h}$	-.092	-.068	.046	.047	.032	.033	.032	.033
	(.067)	(.065)	(.045)	(.082)	(.046)	(.046)	(.045)	(.045)
$ProfessionalQual_{FKP,h}$	.107**	.105**	.004	.008	.008	.017	.008	.017
	(.052)	(.051)	(.034)	(.035)	(.035)	(.035)	(.035)	(.035)
$AllFinLit_h$	.358***	.295**	.221**	.223**	.190**	.194**	.183*	.187**
	(.138)	(.134)	(.091)	(.091)	(.094)	(.094)	(.093)	(.093)
Further households-specific characteristics ξ_h	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
β_0	-4.76***	-3.57*	-2.42***	-2.35***	-4.12***	-3.96***	-4.13***	-3.97***
	(1.136)	(1.112)	(.767)	(.768)	(.791)	(.789)	(.781)	(.779)
R^2	.077	.137	.057	.060	.064	.076	.064	.076
R^2 adj.	.065	.124	.044	.045	.051	.061	.051	.061
F-Test	6.30	10.85	4.28	4.05	4.82	5.23	4.82	5.25
N	787	787	736	736	736	736	736	736

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R^2, adjusted R^2 (R^2 adj.), and F-statistics (F-Test) for the linear regression analyses using the regression models (3a) and (3b). Further households-specific characteristics in ξ_h captures age (Age_h), squared age ($Age^2{}_h$), and gender ($Female_h$) of household's FKP, the monthly household income ($Income_h$), and a dummy variable that indicates whether at least one child at the age of 16 or younger lives in the household ($Child_h$). $ProfessionalQual_h$ captures the professional qualification of the FKP in household h and $AllFinLit_h$ indicates whether household h answered all three financial literacy questions correct. The symbols ***, **, and * denote statistical significance at the one-,

five-, and ten-percent level, respectively. Example: Regressing $PercentageRisky_{h,SP}$ on the regression model (3b) with $ValueSP_h$ as wealth measure yields a coefficient of $ValueSP_h$ of -.046 with no statistical significance and an adjusted R^2 of .045.

The findings of the previous robustness check suggest that households' wealth is of particular importance when households make the decision whether to generally invest in risky assets. Therefore, both models considerably loose explanatory power when they are applied solely on households that invest in risky assets.

5.3 Discussion and Conclusion

Chapter 5 aims at answering the questions whether households show a different RRA in their speculation-portfolio than in their entire portfolio (RQ1) and whether the value of households' speculation-portfolio better explains households' investment policy for their speculation-portfolio than households' total wealth for the entire portfolio (RQ2).

The logit regression analyses show that households' willingness to generally invest in risky asset markets rises with households' total wealth in the model based on the CPCM of Merton (1969) and the value of households' speculation-portfolio in the models based on the BPT. In addition, results of the linear OLS regression analyses suggest that the risky asset share in the CPCM model increases with households' total wealth, while the risky asset share and the ex-post σ in the speculation-portfolio rise with the speculation-portfolio's value. These findings uniformly indicate decreasing RRA as in, Cohn et al. (1975), Morin/Suarez (1983), Riley/Chow (1992), Oehler (1998), Calvet/Sodini (2014), and Oehler/Horn/Wedlich (2018).

The stepwise approach in the regression-analyses reveals that other household characteristics than households' total wealth and the value of households' speculation-portfolio already explain a significant proportion of households' investment policy, measured as the portfolio risky asset share and σ. Furthermore, the respective models' correct estimates/(adjusted) R-squared range within 1.5 percentage points and are, therefore, very similar. When households' total wealth is added as explanatory variable in the CPCM model the increase of the model's explanatory power is less pronounced than the increase of explanatory power when the value of households' speculation-portfolio is added to the model relying on the

BPT. Hence, the value of households' speculation-portfolio adds more explanatory power on top of the household-specific characteristics than households' total wealth in the CPCM model.

The results are robust to households' education and financial literacy and the point in time when the interview took place. However, the previously mentioned results cannot be confirmed when the models are applied solely on the respective subsample of households that invest in risky assets. A possible explanation for this finding is that households' total wealth and particularly the value of households' speculation-portfolio is of notable importance when households decide on whether to generally invest in risky assets. Yet, when households feel like they have accumulated a sufficient amount of wealth and then venture to invest in risky assets, other household characteristics are more decisive for the investment policy.

6 The Relation between Household Wealth and the Efficiency of the Speculation-Portfolio[365]

6.1 Methodological Approach

To answer RQ3, i.e. whether households' total wealth or the value of their speculation-portfolio predicts the speculation-portfolio's efficiency, the empirical analyses in this chapter exclusively focus on the investment policy in households' speculation-portfolio. Households which invest more than 90 percent of their speculation-portfolio's value in the asset classes *money market* and *other financial assets* are excluded from the empirical analyses, because these households are obviously not able to or hardly interested in investing in riskier asset classes[366]. Besides, households whose speculation-portfolio undercuts a value of 1,000 EUR are not considered.

The speculation-portfolios' returns and their standard deviations are calculated on a daily basis with the benchmarks described in Section 4.4.2. The asset class o*ther financial assets* is excluded from these calculations and the sum of the remaining asset classes' percentages is normalized to 100 percent.

Since portfolio efficiency as defined by Markowitz (1952) is a one-period concept, several investment horizons are considered to increase the validity of the analysis. More specifically, the efficiency of households' speculation-portfolios is estimated for the three, six, nine and twelve months, and two, three, and four years after the survey took place.

For each estimation period, an efficient frontier of the ex-post returns is computed with the direct method of Keller et al. (2015). This means that the returns and standard deviation of returns of more than 6000 virtual portfolios are computed per estimation period to build the respective efficient frontier.

[365] This chapter and the referred appendices are substantially obtained from Oehler/Horn (2016).
[366] See Appendix B for a more detailed discussion of this constraint.

The efficiency of the speculation-portfolio of household h in an investment period T is indicated by the three measures *return loss* ($RL_{h,T}$), *unnecessary volatility* ($UV_{h,T}$), and *Sharpe-Ratio*[367] ($SR_{h,T}$).

Return loss[368] is defined as:

$$RL_{h,T} = \mu_{\sigma,T}^{EF} - \mu_{h,T} \quad (4)$$

with

$\mu_{\sigma,T}^{EF}$ as return of the portfolio on the efficient frontier with the same[369] standard deviation of returns σ as the speculation-portfolio of household h in the estimation period T;

$\mu_{h,T}$ as the return of the speculation-portfolio of household h in estimation period T.

Unnecessary volatility is defined as:

$$UV_{h,T} = \sigma_{h,T} - \sigma_{\mu,T}^{EF} \quad (5)$$

with

$\sigma_{h,T}$ as the standard deviation of the returns of the speculation-portfolio of household h in estimation period T;

$\sigma_{r,T}^{EF}$ as the standard deviation of returns of the portfolio on the efficient frontier with the same[370] return μ as the speculation-portfolio of household h in the estimation period T.

Figure 5 provides a graphical illustration of these two measures.

[367] The Sharpe-Ratio builds on the MVT and puts a portfolio's excess returns in relation to the ecexess returns' variance (see Sharpe (1994)). The Sharpe-Ratio was first introduced by Sharpe (1966).

[368] See Calvet et al. (2007) and von Gaudecker (2015). Please note that, in contrast to the previously mentioned studies, the return loss is not calculated under consideration of the market portfolio's Sharpe-Ratio nor is it adjusted for the weight of risky assets. Since the efficient frontier is calculated following the approach of Keller et al. (2015), i.e. without leverage, and with only 5 assets, an increase of the expected σ does not necessarily go hand in hand with an increase of the difference between the highest and the lowest possible portfolio return, particularly in shorter estimation periods. Therefore, adjustments regarding the weight of the risky asset probably would skew the results.

[369] Or a lower standard deviation of returns if portfolios with a higher standard deviation of returns earn lower returns than portfolios with a lower standard deviation of returns. In this case, the highest return of all portfolios with a lower standard deviation of returns is considered for comparison with the household's speculation-portfolio.

[370] Or a higher return if portfolios with a higher standard deviation of returns earn lower returns than portfolios with lower standard deviation of returns. In this case, the lowest standard deviation of returns of all portfolios with higher returns is considered for comparison with the household's speculation portfolio.

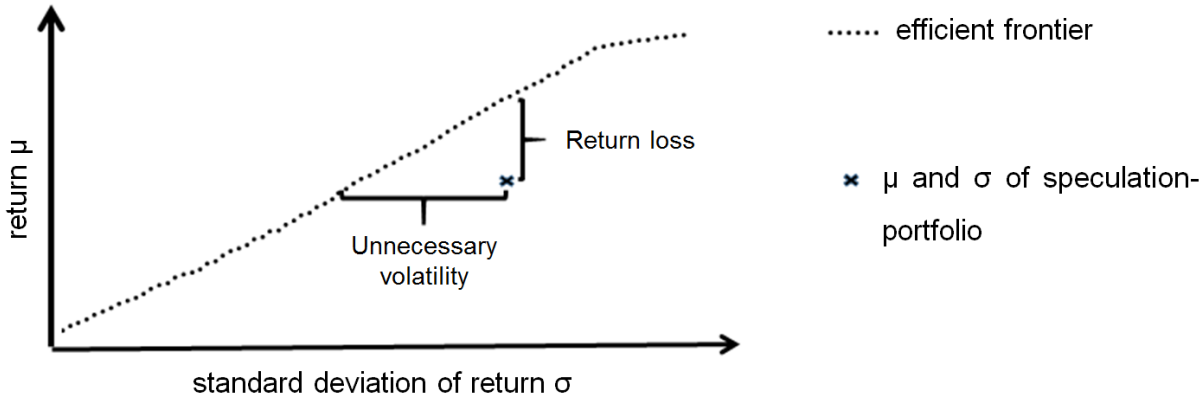

Figure 5: Return loss and Unnecessary volatility

Since the findings in Chapter 5 show that the investment policy of the speculation-portfolio is significantly influenced by its value, correlation analyses are provided to describe the relation between the value and the investment policy[371] as well as the efficiency of households' speculation-portfolio. Linear OLS regression analyses are used to additionally control for the influence of the determinants of households' investment decisions described in Chapter 3 on the efficiency of the speculation-portfolios. The regression analyses rely on three regression models with the measures $RL_{h,T}$, $UV_{h,T}$, and $SR_{h,T}$ as dependent variables.

The logarithmized value of the respective household's speculation-portfolio ($ValueSP_h$), gender ($Female_h$) and age (Age_h)[372] of the household's financial knowledgeable person (FKP), the household's monthly income in EUR ($Income_h$) and its logarithmized total wealth in EUR ($TWealth_h$) are introduced as independent variables. These measures were also employed as control variables by Calvet et al. (2007, 2009b), Hackethal et al. (2012), and von Gaudecker (2015) to analyze households' investment performance. Furthermore households' assessment whether their income is appropriate to make ends meet ($ApprIncome_h$), households' self-assessed risk aversion regarding the financial domain ($RiskAtt_h$), and household's

[371] If households' asset location were not related with wealth, differences in households' portfolio efficiency – if existent – were most probably caused by lower fees for the wealthier households. In addition, a look on the relation between the speculation-portfolio's value and its investment policy is only necessary when market participants are not able to/do not invest in the neoclassical market portfolio. Otherwise, all portfolios would show the same degree of efficiency.

[372] The FKP's squared age is not included since findings of Nicolosi et al. (2009) and Calvet et al. (2009b) suggest a linear, if any, relation between age and investment performance (see Section 3.2.3).

estimation whether they will be able to save in the next year ($FutSavings_h$) are included.[373] The three full regression models are set up as follows:

$$RL_{h,T} = \beta_0 + \beta_1 * lnValueSP_h + \beta_2 * Female_h + \beta_3 * Age_h + \beta_4 * Income_h + \beta_5 * lnTWealth_h + \beta_{6,} * RiskAtt_h + \beta_7 * ApprIncome_h + \beta_8 * FutSavings_h + \varepsilon \quad (6)$$

with

$Female_h$ as 1 if the household's FKP is female (N=279) and 0 if the household's FKP is male (N=551);

$RiskAtt_h$ as 1 if households state that they are not willing to take financial risks at all, 2 if households are willing to take average financial risks, and 3 if households are willing to take above average financial risks;[374]

$ApprIncome_h$ as ranging from 1 „households' financial income covers the needs with great difficulty" to 4 "households' financial income covers the needs easily";[375]

$FutSavings_h$ as 1 if the household members think they are able to only save a smaller share in the future, 2 if the household members think they are able to save the same share in the future, and 3 if the household members think they are able to save a larger share in the future.[376]

$$UV_{h,T} = \beta_0 + \beta_1 * lnValueSP_h + \beta_2 * Female_h + \beta_3 * Age_h + \beta_4 * Income_h + \beta_5 * lnTWealth_h + \beta_6 * RiskAtt_h + \beta_7 * ApprIncome_h + \beta_8 * FutSavings_h + \varepsilon \quad (7)$$

$$SR_{h,T} = \beta_0 + \beta_1 * lnValueSP_h + \beta_2 * Female_h + \beta_3 * Age_h + \beta_4 * Income_h + \beta_5 * lnTWealth_h + \beta_6 * RiskAtt_h + \beta_7 * ApprIncome_h + \beta_8 * FutSavings_h + \varepsilon \quad (8)$$

[373] Since previous studies did not find an influence of the presence of children in a household on portfolio efficiency, this variable is not included.

[374] This variable includes both items HD1800 and DHD2800. "Above average risk" merges households that answered question HDI1800 or DHD2800 with "substantial" or "above-average" financial risks because of the small amount of households that choose the answer "substantial".

[375] Households' answer on question DHI0800. See Appendix C Table 33 for descriptive statistics regarding this variable.

[376] Households' answer on question HNI0700. See Appendix C Table 34 for descriptive statistics regarding this variable.

The robustness of the regression analyses' results is controlled with ANOVA analyses to discover differences between households with different saving purposes, graduation, professional qualification, and financial literacy. Also, different subsamples according to the point in time when the households were interviewed are analyzed.

6.2 Results

6.2.1 Descriptive statistics and correlation analyses

Descriptive statistics of the asset allocation in households' speculation-portfolios are presented in Table 10. Of the original dataset, 830 households have a speculation-portfolio with a value of at least 1,000 EUR and invest less than 90 percent of the portfolio in the asset classes *money market* and *other financial assets*. The mean value of households' speculation-portfolios is 192,141 EUR. The median value is considerably lower with 74,050 EUR, indicating the well-known right-skewed distribution of wealth. On average, the households invest 42 percent of the portfolio in the asset class *money market*, 22 percent in *stocks*, 13 percent in *articles of great value*, 12 percent in *Bonds*, 4 percent in *real estate funds* and 8 percent in *other financial assets*. The respective median values show that more than half of the households do not invest in bonds, real estate funds or articles of great value.

Table 10: Descriptive statistics of speculation-portfolios

		Percentage invested in asset classes					
	$ValueSP_h$ in EUR	Stocks	Bonds	Money market	Real estate funds	Articles of great value	Other financial assets
Mean	192,141	22	12	42	4	13	8
20th percentile	27,920	0	0	13	0	0	0
Median	74,050	13	0	40	0	0	0
80th percentile	219,240	42	24	72	0	23	14
Std.	488,844	25	20	27	12	22	14
N	830	830	830	830	830	830	830

Notes: The table displays descriptive statistics of the speculation-portfolios that exceed a net value of 1,000 EUR and invest less than 90 percent of the portfolio in the asset classes *money market* and *other financial assets*. It reports mean and median values, the 20^{th} and 80^{th} percentile and the standard deviation (Std.) of the value of the 830 speculation-portfolios in EUR as well as of the percentages of the portfolios that are invested in the asset classes *stocks*, *bonds*, *money market*, *real estate funds*, *articles of great value*, and *other financial assets*. Example: The mean value of the percentage invested in the asset class *money market* is 42 with a standard deviation of 27. The 20th percentile is 13 and the median value is 40 percent. Twenty percent of the households invest more than 72 percent of their speculation-portfolio in the asset class *money market* (80th percentile).

In Table 11, Pearson correlation coefficients are provided to analyze whether the value of the speculation-portfolio generally interacts with the different asset class weights within the portfolio. The results show that the value of households' speculation-portfolios positively correlates with the portfolio share of *stocks*, *bonds*, and *other financial assets* with a statistical significance at least at the five-percent level. In contrast, the percentage invested in the asset class *money market* is higher in speculation-portfolios with a lower value with a statistical significance at the one-percent level.[377]

Table 11 Correlation Coefficients (Pearson) between the portfolios' net value and the asset class weights

	Stocks	Bonds	Money market	Real estate funds	Articles of great value	Other financial assets
$ValueSP_h$	.088**	.125***	-.183***	.021	-.065*	.104***

Notes: The table provides Pearson correlation coefficients between the value of households' speculation-portfolios and the percentage of the portfolio the households invest in the asset classes *stocks*, *bonds*, *money market*, *real estate funds*, *articles of great value*, and *other financial assets*. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively.

Correlation analyses of the value of households' speculation-portfolios with the realized return, standard deviation of returns, return loss**,** unnecessary volatility, and Sharpe-Ratio of households' speculation-portfolio are performed with different estimation periods of up to four years. The results are presented in Table 12. More valuable speculation-portfolios show a higher standard deviation of returns than less valuable speculation-portfolios; however, the correlation coefficients are not statistically significant in most cases. Surprisingly, the value of households' speculation-portfolios correlates negatively with the achieved return, particularly in the nine and the twelve months estimation period. Along these lines, speculation-portfolios with a higher value have statistically significant higher return losses (at least at the ten-percent level in all estimation periods) and suffer from higher unnecessary volatility and lower Sharpe-Ratios.

[377] These results support former findings of Badarinza et al. (2016), Campbell (2006) and (2016), Calvet et al. (2009a), and Calvet/Sodini (2014) according to which the amount invested in stocks or bonds increases with household wealth.

Table 12: Correlation coefficients (Pearson) between the value of households' speculation-portfolios and the return, standard deviation of returns, return loss, unnecessary volatility, and Sharpe-Ratio of the speculation-portfolio

T	$\mu_{h,T}$	$\sigma_{h,T}$	$RL_{h,T}$	$UV_{h,T}$	$SR_{h,T}$
3 months	-.007	.033	.058*	.017	.013
6 months	-.030	.032	.061*	.014	.000
9 months	-.094***	.040	.106*	.087**	-.099**
12 months	-.111***	.054	.104***	.118***	-.092***
2 years	-.022	.057	.074**	.085**	-.055
3 years	.030	.057	.068*	.071**	-.029
4 years	.026	.057*	.063*	.071**	-.039

Notes: The table provides Pearson correlation coefficients between the value of households' speculation-portfolio and the return $\mu_{h,T}$, standard deviation of returns $\sigma_{h,T}$, return loss $RL_{h,T}$, unnecessary volatility $UV_{h,T}$ (both as deviation from the efficient frontier of the respective estimation period), and Sharpe-Ratio $SR_{h,T}$. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: For the estimation period which started one day and ends 3 months after the households had been interviewed, the Pearson correlation coefficient between the value of households' speculation-portfolios and the return loss of households' portfolios is .058 with a statistical significance at the ten-percent level.

6.2.2 Regression analyses

Regression analyses using the models of equations (6)-(8) are provided to examine if household wealth (either measured as total wealth or the value of the speculation-portfolio) has an influence on the speculation-portfolios' efficiency in the presence of further determinants of households' investment decisions.[378]

Results of the regression model employing equation (6) concerning households' return loss are presented in Table 13. Like in the previous correlation analyses, a positive relation between $ValueSP_h$ and their return loss is observed. However, the respective regression coefficients are not statistically significant. Likewise, the variables Age_h, $Income_h$, $TWealth_h$, $ApprIncome_h$, and $FutSavings_h$ have no statistically significant influence. In contrast, the gender of the household's FKP significantly impacts the return loss of the speculation-portfolio: If the FKP is female, the return loss is lower and, hence, the speculation-portfolio is more efficient. An even stronger influence can be observed for households' risk attitude. The more risks the households are willing to take, the higher their speculation-portfolio's return loss

[378] For reasons of better readabiliy, results for 3 and 9 month estimation periods are not reported in the results tables. However, the results of these estimation periods support the findings of the remaining estimation periods.

is. Taken together, no empirical evidence can be found that more wealthy households (households with higher income, higher total wealth[379] or with a more valuable speculation-portfolio) have a speculation-portfolio with lower return losses.

Table 13: Influence of households' characteristics on the return loss of households' speculation-portfolios

Estimation period of $RL_{h,T}$:	0.5 yrs	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	.001 (.003)	.003 (.002)	.001 (.001)	.000 (.001)	.000 (.001)
$Female_h$	-.015** (.007)	-.010** (.004)	-.008*** (.003)	-.003* (.001)	-.004** (.002)
Age_h	.000 (.000)	.000 (.000)	.000 (.000)	-.000 (.000)	-.000* (.000)
$Income_h$	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
$lnTWealth_h$	.001 (.003)	.002 (.002)	.001 (.001)	.001 (.001)	.001 (.001)
$RiskAtt_h$	.045*** (.006)	.035*** (.004)	.022*** (.003)	.010*** (.001)	.012*** (.001)
$ApprIncome_h$	-.003 (.005)	-.003 (.003)	-.002 (.002)	-.001 (.001)	-.001 (.001)
$FutSavings_h$	.004 (.005)	.003 (.003)	.003 (.002)	.000 (.001)	.001 (.001)
β_0	.000 (.039)	-.036 (.026)	.009 (.017)	.002 (.009)	.006 (.009)
R^2	.087	.124	.117	.097	.116
R^2 adj.	.078	.115	.108	.088	.108
F-Test	9.764	14.441	13.472	10.981	13.425

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R^2, adjusted R^2 (R^2 adj.), and F-statistics (F-Test) for the regression analysis using equation (6) with the return loss of households' speculation-portfolio per estimation period as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing the return loss of households' speculation-portfolios of the year after the survey had taken place on the model of equation (6) yields a coefficient of the value of the speculation-portfolio of .003 with no statistical significance and an adjusted R^2 of .115.

Results of the regression analysis that uses equation (7) to analyze the determinants of the unnecessary volatility in households' speculation-portfolio are provided in

[379] See Appendix D Table 36 and Table 37 for the results of the stepwise regression analyses that show no significant relation between households' income or total wealth and the return loss of their speculation-portfolio.

Table 14. The unnecessary volatility of households' speculation-portfolio is significantly influenced by the value of the speculation-portfolio, the gender of the FKP and the households' risk attitude. All remaining variables are not statistically significant.[380] These results support the findings of the regression analysis concerning the return loss. Again, those households which are willing to take the highest risks hold the speculation-portfolios with the largest amount of unnecessary volatility. If females manage the speculation-portfolio, it is more efficient. Results regarding the value of households' speculation-portfolio are ambiguous. While households with a more valuable speculation-portfolio suffer less from unnecessary volatility in the first 6 month after the survey, they suffer more from unnecessary volatility in the one year period.

[380] See Appendix D Table 38 and Table 39 for the results of the stepwise regression analyses that show no significant relation between households' income or total wealth and the unnecessary volatility of their speculation-portfolio.

Table 14: Influence of households' characteristics on the unnecessary volatility of households' speculation-portfolios

Estimation period of $UV_{h,T}$:	0.5 yrs	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	-.005* (.003)	.005* (.003)	.001 (.002)	.000 (.001)	.000 (.001)
$Female_h$	-.003 (.006)	-.010* (.005)	-.008* (.004)	-.005** (.002)	-.005** (.002)
Age_h	.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
$Income_h$	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
$lnTWealth_h$	-.003 (.003)	.001 (.002)	.001 (.002)	.001 (.001)	.001 (.001)
$RiskAtt_h$	.020*** (.005)	.040*** (.005)	.028*** (.004)	.017*** (.002)	.017*** (.002)
$ApprIncome_h$	-.004 (.004)	-.004 (.004)	-.002 (.003)	-.001 (.002)	-.001 (.002)
$FutSavings_h$	.004 (.004)	.003 (.004)	.003 (.003)	.001 (.002)	.001 (.002)
β_0	.136*** (.034)	-.033 (.030)	-.001 (.024)	-.001 (.014)	-.001 (.014)
R^2	.030	.121	.096	.099	.101
R^2 adj.	.020	.113	.087	.090	.092
F-Test	3.113	14.087	10.867	11.185	11.443

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R^2, adjusted R^2 (R^2 adj.), and F-statistics (F-Test) for the regression analysis using equation (7) with the unnecessary volatility of households' speculation-portfolio per estimation period as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing the unnecessary volatility of households' speculation-portfolios of the year after the survey had taken place on the model of equation (7) yields a coefficient of the value of the speculation-portfolio of .005 with a statistical significance at the ten-percent level and an adjusted R^2 of .113.

In Table 15, the results of the regression analysis that examines the factors which influence the Sharpe-Ratios of households' speculation-portfolios using the model of equation (8) are presented. By and large, the results confirm the findings of the previous two regression analyses, although, the regressions' adjusted R-squared are lower than in the previous analyses. Besides the three factors *ValueSP*$_h$, *Female*$_h$, and *RiskAtt*$_h$, the factor *Age*$_h$ also influences the Sharpe-Ratio of the speculation-

portfolio at a statistically significant level.[381] More precisely, the speculation-portfolio's Sharpe-Ratio rises with the age of the FKP.

Table 15: Influence of households' characteristics on the Sharpe-Ratio of households' speculation-portfolios

Estimation period of $SR_{h,T}$:	0.5 yrs	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	-.005 (.038)	-.035** (.016)	-.006 (.011)	-.002 (.006)	.003 (.008)
$Female_h$	.025 (.077)	.064** (.032)	.060** (.023)	.031** (.013)	.040** (.017)
Age_h	.002 (.003)	.003** (.001)	.003*** (.001)	.001*** (.000)	.002*** (.001)
$Income_h$	.000 (.000)	.000 (.000)	.000 (000)	.000 (.000)	.000 (.000)
$lnTWealth_h$	-.044 (.035)	-.012 (.014)	-.010 (.011)	-.008 (.006)	-.006 (.008)
$RiskAtt_h$	-.205*** (.069)	-.148*** (.028)	-.121*** (.021)	-.048*** (.012)	-.072*** (.015)
$ApprIncome_h$	.021 (.059)	.031 (.024)	.020 (.018)	.011 (.010)	.011 (.013)
$FutSavings_h$	.008 (.055)	-.026 (.023)	-.020 (.017)	-.001 (.009)	-.020 (.012)
β_0	.191 (.455)	.376 (.187)	.590*** (.137)	.587*** (.077)	.721*** (.098)
R²	.017	.074	.086	.053	.070
R² adj.	.007	.065	.077	.044	.061
F-Test	1.729	8.138	9.626	5.704	7.677

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R², adjusted R^2 (R² adj.), and F-statistics (F-Test) for the regression analysis using equation (8) with the Sharpe-Ratio of households' speculation-portfolios per estimation period as dependent variable. The symbols *** and ** denote statistical significance at the one- and five-percent level, respectively. Example: Regressing the Sharpe-Ratio of households' speculation-portfolios of the year after the survey had taken place on the model of equation (8) yields a coefficient of the value of the speculation-portfolio of -.035 with a statistical significance at the five-percent level and an adjusted R² of .065.

In a nutshell, so far it cannot be attested that more wealthy households (households with higher income, higher total wealth, or with a more valuable speculation-portfolio) have a more efficient speculation-portfolio than less wealthy households. Instead, the gender of the FKP and the household's risk attitude seem to be the factors that have

[381] See Appendix D Table 40 and Table 41 for the results of the stepwise regression analyses that show no significant relation between households' income or total wealth and the Sharpe-Ratio of their speculation-portfolio.

the strongest influence on the speculation-portfolios' efficiency. Other factors such as households' income, total wealth or their estimation regarding future savings are not statistically significant.

6.2.3 Robustness Checks

The analyzed sample of households is split accordingly to the three quarters in which the households were interviewed in order to check whether the results could have been mainly driven by some households in a specific time period. Table 42 in Appendix E includes the results of the correlation analyses by quarter. Although, it cannot be attested that the results in all subsamples are identical, the overall tendency stays stable. More importantly, there is no statistically significant correlation coefficient that contradicts the findings of the previous analyses. Appendix F shows the regression analyses of the full model of equations (6)-(8) by quarter. All results for models and estimation periods with an adjusted R^2 of at least .05 support the results of the former regression analyses throughout. In addition, no statistically significant regression coefficients that cut across the overall findings can be found; neither for the models with the speculation-portfolios' return loss, nor with speculation-portfolios' unnecessary volatility, or Sharpe-Ratio as dependent variable.

The analysis follows von Gaudecker (2015) and estimates whether the education of the households' FKP (measured as *graduation* and *professional qualification*)[382] significantly influences the asset allocation in households' speculation-portfolio. For this purpose, ANOVA analyses are performed which control for significant differences between households with different education with respect to the value of the households' speculation-portfolio as well as their monthly income and their total wealth and the percentages invested in the different asset-classes.

Since van Rooij et al. (2011) state that investors with higher financial literacy are more likely to invest in stocks, it is additionally tested whether the financial literacy of the household's FKP influences the asset allocation in households' speculation-portfolios. In the same line, ANOVA analyses are performed to discover differences between households with different saving purposes.

[382] Households that do not specify their education or professional qualification are excluded from these analyses.

The results of the ANOVA analyses are presented in Table 16. They show that differences in the education of the households' FKP go hand in hand with differences in the value of households' speculation-portfolio and households' monthly income. The same is true for differences in the saving purpose. However, significant differences regarding the percentages of the portfolio that households invest in the six asset classes can hardly be observed. The only exception is the asset class *articles of great value* in context of the variable *professional qualification*. However, since the average percentages invested in this asset class vary only in a range between .08 and .16 per subsample accordingly to the professional qualification, it seems doubtable that this variation significantly disrupts the robustness of the results. Differences in households' financial literacy are neither responsible for differences in households' wealth nor for the asset allocation in households' speculation-portfolio. Therefore, it can be concluded that households' education and financial literacy as well as households' saving purpose hardly explain the asset allocation of households' speculation-portfolio and, as a consequence, its efficiency.

Table 16: ANOVA graduation, professional qualification and purpose for saving

	p-values			
	Graduation	Professional qualification	Financial literacy	Purpose for saving
$lnValueSP_h$	.007	.000	.605	.047
$Income_h$	.000	.000	.632	.035
$lnTWealth_h$	.132	.056	.114	.496
Percentage Stocks	.234	.182	.179	.219
Percentage Bonds	.480	.271	.136	.439
Percentage Money market	.623	.147	.061	.107
Percentage Real estate funds	.200	.678	.498	.536
Percentage Articles of great value	.517	.013	.832	.227
Percentage Other financial assets	.582	.345	.417	.482

Notes: The table provides p-values of ANOVAs that analyze the influence of the household's FKPs' graduation, professional qualification, and financial literacy as well as household's purpose for saving on the differences between the values of households' speculation-portfolios ($lnValueSP_h$), monthly household income ($Income_h$), total wealth ($lnTWealth_h$), and the percentages of the portfolio invested in the different asset classes. As purposes for saving "larger purchase excl. vehicles", "funds for emergency situations", "old-age provision", and "supporting children or grandchildren" are considered.

6.2.4 A closer look on the differences between portfolios managed by women and men and portfolios of households with different risk attitudes

The regression analyses in Section 6.2.2 unfold that the gender of households' FKP and households' self-reported risk attitude significantly influence the efficiency of households' speculation-portfolio. To point out the differences between portfolios managed by women and men as well as portfolios of households with different risk attitudes mean values and respective t-tests are provided regarding the household wealth, speculation-portfolio's asset allocation, and speculation-portfolio's outcomes subdivided by the FKP's gender and risk attitude.

Table 17 contains a comparison of households with female and male FKP. Households with a female FKP show significantly less valuable speculation-portfolios

and less monthly income. Female FKPs hold significantly smaller percentages in *stocks*[383] but larger percentages in *articles of great value*. This combination leads to slightly higher average returns and a lower volatility (both not statistically significant) compared to the outcomes of speculation-portfolios managed by men. Furthermore, female managed speculation-portfolios show lower return losses, less unnecessary volatilities, and higher Sharpe-Ratios with a statistical significance at the one-percent level regarding all three measures.

Table 17: Comparison of households with female and male FKP

	Female	Male	p-value
$ValueSP_h$	122,644	227,331	.004
$Income_h$	3,591	4,496	.000
$TWealth_h$	534,029	656,950	.106
Percentage Stocks	18	24	.000
Percentage Bonds	12	12	.920
Percentage Money market	44	41	.193
Percentage Real estate funds	4	3	.265
Percentage Articles of great value	16	11	.008
Percentage Other financial assets	7	8	.140
Annual excess return (4 yrs., in percent)	5.1	4.9	.493
Annual standard deviation of returns (4 yrs., in percent)	7.6	8.1	.165
Annual return loss (4 yrs., in percent)	2.5	3.0	.001
Annual unnecessary volatility (4 yrs., in percent)	2.8	3.6	.001
Annual Sharpe-Ratio (4 yrs.)	.71	.66	.004
N	279	551	

Notes: The table provides mean values of households' wealth measures ($ValueSP_h$, $Income_h$, $TWealth_h$), percentages of the speculation-portfolio invested in the different asset classes, and portfolio outcomes subdivided by the gender of households' FKP. Annual excess return is the return of households' speculation-portfolio minus the risk-free rate in the respective period of time. The table furthermore reports p-values of the t-tests used to test equality of the mean values.

[383] This finding is in accordance with Agnew et al. (2003), Barber/Odean (2001), Dwyer et al. (2002), Halko et al. (2012).

The regression analyses employing the models (6) – (8) showed that households' risk attitude is the most significant factor of influence regarding the efficiency of households' speculation-portfolio. In Table 18, mean values of households' wealth measures, asset allocation, and annual portfolio outcomes over the four year investment period are provided categorized by households' self-reported risk attitude (*no risks*, *average risks*, *above average risks*) to reveal the differences between the households in these three categories. In addition, the p-values of the ANOVA analyses that compare households of the three categories are presented.

The 286 households that denote their willingness to take financial risk with *no risks* own less valuable speculation-portfolios and have lower monthly incomes than the remaining households. However, households' total wealth does not differ between the three risk attitude categories at statistically significant levels and neither do the percentages invested in *bonds* and *real estate funds*. Households that assess themselves as taking *no risks* invest on average 13 percent of their speculation-portfolio in stocks, which is significantly less compared to the households that label themselves as taking *average risks* (25 percent in *stocks*) or *above average risks* (49 percent in *stocks*). An inverse effect can be observed for the percentages invested in the asset class m*oney market*. Households which state that they do not take risks at all invest nearly half of their portfolio value in *money market*. In contrast, the 44 households that are willing to take above average risks invest only a quarter of their speculation-portfolio in the asset class *money market*. The 500 households stating to take average risks invest 40 percent of their speculation-portfolio in this asset class. A similar pattern appears for the percentages invested in the asset class *articles of great value*. Again, the percentages invested in this asset class shrink when households' willingness to take risks rises. Regarding the asset classes *bonds* and *real estate funds* no statistically significant tendency can be found. To sum up, with rising willingness to take risks, households invest statistically significant larger percentages of their speculation-portfolios in stocks and smaller percentages in the asset classes *articles of great value* and *money market*.

Considering the portfolio outcomes, households' self-reported risk attitude is reflected by the σ of households' speculation-portfolios. Households that are willing to take higher risks have speculation-portfolios with a mean annual σ of 12 percent over a 4

year estimation period. The latter differs at the one-percent level from the households that state to take no risks (σ of 7.1 percent) or average risks (σ of 8 percent). Yet, households' willingness to take additional risks was hardly recompensed in the four year period from 2011 to 2015. The mean annual portfolio return is roughly the same over the three categories. Consequently, households with higher willingness to take financial risk suffer from statistically significant higher return losses, higher unnecessary volatility and lower Sharpe-Ratios.

Moreover, the mean age of the household's FKP is significantly different between the three categories. Households that state to take *no risks* have a statistically significant higher age than households which take *average risks*. The households which are willing to take *above average risks* are the youngest, on average.

Amongst female FKPs, 119 of 279 (43 percent) state to not take any financial risk at all, whereas only 30 percent (167 of 551) of the male FKPs state the same. On the contrary, seven percent (36 of 551) of the male FKPs are willing to take above average risks; twice as many as female FKPs (3 percent; 8 of 279).

Table 18: Comparison of households according to their self-reported risk attitude

	no risks	average risks	above average risks	p-value
$ValueSP_h$	126,446	232,754	157,652	.012
$Income_h$	3,489	4,536	4,845	.002
$TWealth_h$	598,017	639,441	459,545	.558
Percentage Stocks	13	25	49	.000
Percentage Bonds	12	12	9	.727
Percentage Money market	48	40	26	.000
Percentage Real estate funds	4	4	2	.422
Percentage Articles of great value	19	10	4	.000
Percentage Other financial assets	5	9	10	.000
Annual excess return (4 yrs., in percent)	5.0	4.9	5.8	.217
Annual standard deviation of returns (4 yrs., in percent)	7.1	8.0	12.0	.000
Annual return loss (4 yrs., in percent)	2.1	3.1	5.4	.000
Annual unnecessary volatility (4 yrs., in percent)	2.3	3.6	7.1	.000
Annual Sharpe-Ratio (4 yrs.)	.73	.66	.52	.000
Mean (Median) Age_h	62 (64)	57 (58)	49 (45)	.001
N	286	500	44	
With female FKP	119	152	8	
With male FKP	167	348	36	

Notes: The table provides mean values of households' wealth measures ($ValueSP_h$, $Income_h$, $TWealth_h$), percentages of the speculation-portfolio invested in the different asset classes, and portfolio outcomes subdivided by households' self-reported risk attitude. Annual excess return is the return of households' speculation-portfolio minus the risk-free rate in the respective period of time. In addition, the table reports p-values of the ANOVAs that analyze the influence of households' risk attitude on these mean values.

6.2.5 The determinants of households' self-reported risk attitude

The comparison of households with different risk attitudes clarifies that these households also significantly differ in some sociodemographic and -economic aspects (wealth as well as age and gender of their FKPs). For this reason, another linear regression analysis with households' risk attitude as dependent variable and

their sociodemographics and -economics as independent variables is provided to examine the factors that actually drive households' self-reported risk attitude.

The results of this analysis are shown in Table 19. Indeed, the age and gender of the household's FKP significantly drive household's self-reported risk attitude. Female FKPs are less prone to take risks than male FKPs. Furthermore, a household's willingness to take risks decreases when the FKP gets older. Regarding the wealth measures, it again appears that the value of household's speculation-portfolio is the only statistically significant factor of influence. Households are willing to take higher risk with increasing value of their speculation-portfolio.

Table 19: Determinants of households' self-reported risk attitude

$lnValueSP_h$	.075*** (.015)			.123*** (.019)
$Female_h$		-.160*** (.041)		-.131*** (.039)
Age_h			-.008*** (.001)	-.011*** (.001)
$Income_h$				.000 (.000)
$lnTWealth_h$				-.025 (.018)
β_0	.868*** (.171)	1.762*** (.024)	2.183*** (.077)	1.455*** (.216)
R^2	.029	.018	.046	.126
R^2 adj.	.028	.017	.045	.121
F-Test	24.450	15.434	40.130	23.750

Notes: The table provides regression coefficients, R^2, and adjusted R^2 for the regression analysis with households' self-reported risk attitude as dependent variable. The symbol *** denotes statistical significance at the one-percent level.

The previous findings are summarized in Figure 6. The most influential factor regarding the efficiency of households' speculation-portfolio is their self-reported risk attitude. Households which are willing to take higher risks implement less efficient speculation-portfolios. Risk attitude, in turn, is not an independent construct, but is significantly influenced by the age and gender of households' FKP as well as the value of households' speculation-portfolio. The households which own more valuable speculation-portfolios show a higher willingness to take risks than households with less valuable portfolios. Older FKPs tend to avoid risks, whereas younger FKPs show

a higher willingness to take risks. Likewise, male FKPs show a stronger tendency to take above average risks, whereas female FKPs shun risks.

Additionally, age and gender of households' FKP have a direct impact on the efficiency of households' speculation-portfolio. Older FKPs' speculation-portfolios earn higher Sharpe-Ratios than the speculation-portfolios of their younger peers. Speculation-portfolios of female FKPs are more efficient than those of male FKPs. All in all, no evidence that the efficiency of a household's speculation-portfolios rises with household wealth can be found.

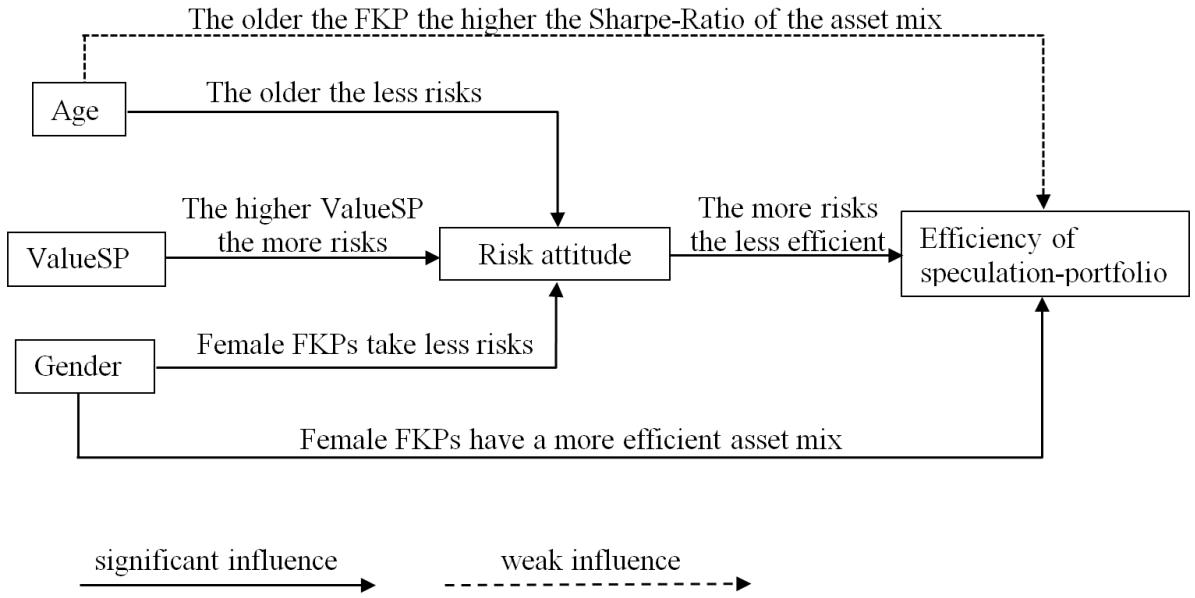

Figure 6: Determinants of the efficiency of households' speculation-portfolio

6.3 Discussion and Conclusion

Chapter 6 aims at answering the question whether households' total wealth or the value of their speculation-portfolio predicts the efficiency of their speculation-portfolio for a buy-and-hold strategy. The results of the previous analyses show no direct relation between household wealth and the efficiency of the speculation-portfolio. Instead, the gender of the FKP and the household's risk attitude significantly influence the speculation-portfolio's efficiency. The analysis of the determinants of households' risk attitude, however, reveals that the value of households' speculation-portfolio has some statistically significant influence. Hence, households' risk attitude serves as a mediator for the influence of the value of households' speculation-

portfolio on the speculation-portfolio's efficiency.[384] Still, more valuable speculation-portfolios are not more efficient, as findings of Vissing-Jorgensen (2004) and Calvet et al. (2007) and (2009) would suggest. Instead, the results of the regression analyses could indicate that households with more valuable speculation-portfolios suffer from less efficiency. This statement, however, should be treated with caution for two reasons. First, the adjusted R-squared of the respective full regression models in Table 13, Table 14, Table 15, and Table 19 never exceed 12 percent (the model with the value of the speculation-portfolio as single explanatory variable for households' risk attitude in Table 19 only yields an adjusted R^2 of 2.8 percent). Considering the significant influence of the FKP's age and gender, this leaves little explanatory power for the mediator effect. Second, the relation between the value and the efficiency of the speculation-portfolio may also (partially) be caused by the following effect observed by Calvet et al. (2007): "Rich and educated households select portfolios with a high Sharpe ratio but also a high risky share, resulting in a high complete return loss. Conversely, unsophisticated households allocate a small fraction of their financial wealth to an inefficient risk portfolio and overall incur low complete portfolio return losses" (Calvet et al. 2007, p. 738).

In a nutshell, it is doubtful that the efficiency of households' speculation-portfolios is driven by the speculation-portfolios' value; households' total wealth and income show no statistically significant influence. For a prediction of the speculation-portfolios' efficiency, the age and gender of the FKP and households' risk attitude are more suitable. This result is robust to other factors like household members' estimation regarding future savings and the FKP's formal level of education or financial literacy. Hence, previous findings of Nicolosi et al. (2009), Seru et al. (2010), and (partially, because no adverse effects of cognitive aging are found) Korniotis/Kumar (2011) who state that more experienced/older investors show greater investment knowledge are supported. The analyses furthermore support the finding of Schooley/Worden (1996) who attest that the households were able to compose their portfolio in accordance to their self-reported risk attitude (maybe with the assistance of their financial advisers).

[384] Goodman-Tests (1960) including the value of the speculation-portfolio as independent variable, the 4-year Sharpe-Ratio as dependent variable, and households' risk attitude as mediator reveal a t-value of 3.38 indicating (considering the sample size of 830) that the indirect effect of the value of households' speculation-portfolio on the speculation-portfolio's 4-year Sharpe-Ratio is statistically significant at the one-percent level.

Consequently, households seem to be aware of the basic risks and opportunities of the asset classes they invest in.

7 The Effects of Automated Portfolio Rebalancing on the Efficiency of Households' Speculation-Portfolio[385]

7.1 Methodological Approach

This chapter's aim is to answer RQ4 and RQ5, i.e. whether the efficiency of the 830 speculation-portfolios analyzed in Chapter 6 can be enhanced by portfolio rebalancing and whether households' total wealth or the value of their speculation-portfolio influences the respective effect of portfolio rebalancing.

Again, the asset class o*ther financial assets* is excluded in the empirical analysis and the sum of the remaining asset classes' percentages is normalized to 100 percent. It is assumed that each household of one quarter was interviewed on the same day in the middle of the quarter. The efficiency of households' speculation-portfolio is estimated with the returns of the benchmarks described in Section 4.4.2.

The analysis's methodology has to fulfill three requirements. First, to measure the differences in portfolio efficiency that arise from employing a rebalancing strategy instead of a buy-and-hold-strategy. Second, to identify the speculation-portfolios, or more precisely their asset weights, that benefitted from a rebalancing strategy. Third, to derive the characteristics of the households that benefitted from rebalancing their speculation-portfolio.

For these purposes, the performance of households' speculation-portfolios resulting from a buy-and-hold strategy over a 4 year period as computed in Section 6.2 is compared to the performance that households' speculation-portfolios would have yielded with (a) periodical rebalancing strategies with rebalancing after (a1) one month or (a2) one year, and (b) threshold rebalancing strategies with rebalancing when the worst and best performing asset classes' returns in a household's speculation-portfolio diverge by (b1) 5%, (b2) 10%, or (b3) 20% compared to the last

[385] This chapter and the referred appendices are substantially obtained from Horn (2018).

rebalancing.[386] With the rebalancing of the speculation-portfolio, all asset classes' weights of a portfolio are set back to their initial values. The portfolio outcomes are computed as the mean portfolio return (μ), the standard deviation of the portfolio returns (σ), and the portfolio's Sharpe-Ratio.[387]

However, it seems possible that rebalancing strategies not only change the μ and σ of a portfolio but also the skewness and kurtosis of the portfolio's return distribution. In this case, households might benefit from rebalancing when the adjustment of the asset weights leads to a more favorable distribution of the speculation-portfolio's returns although μ, σ, and the Sharpe-Ratio stay the same.[388] To capture the latter effect, the change of the Adjusted Sharpe-Ratio[389] through portfolio rebalancing is analyzed. The Adjusted Sharpe-Ratio for the portfolio of household h (ASR_h) is computed as:

$$ASR_h = SR_h\left(1 + \left(\frac{Skewness_h}{6}\right) SR_h - \left(\frac{[Kurtosis_h - 3]}{24}\right) SR^2{}_h\right) \qquad (9)$$

with

SR_h as the Sharpe-Ratio of the speculation-portfolio of household h.

The Adjusted Sharpe-Ratio incorporates a penalty (gain) factor (the term in parentheses) for negative (positive) skewness and excess (limited) kurtosis (ASR-Factor). If this factor increases, rebalancing has a favorable effect for risk averse households regarding the skewness ($Skewness_h$) and kurtosis ($Kurtosis_h$) of their speculation-portfolio's return distribution.[390] Additional performance measures are not considered since previous studies show that the choice of the performance measure

[386] Additionally, households' portfolio performance for strategies that combine threshold strategies with periodical strategies, e.g. a strategy that either immediately rebalances the portfolio if a 5 percent threshold level is exceeded or if the portfolio was not rebalanced in the previous month have been calculated. However, the outcomes of these strategies (e.g. 5 percent threshold plus monthly rebalancing yielded on average an annual μ of 6.290 percent, σ of 7.900 percent, and Sharpe-Ratio of .7100) were not different from the outcomes of the threshold strategies (e.g. 5 percent threshold rebalancing yielded on average an annual μ of 6.285 percent, σ of 7.905 percent, and Sharpe-Ratio of .7088) at statistically significant levels. Therefore, this chapter solely focuses on the threshold and periodical strategies to more clearly derive the effects of the separate strategies on households' portfolio outcomes. For an overview regarding various types of rebalancing strategies see Daryanani (2008).

[387] See e.g. Hilliard/Hilliard (2018) for a similar approach.

[388] See Guse/Rudolf (2008) and Scott/Horvath (1980) who show that risk averse investors prefer positively skewed return distributions with low kurtosis.

[389] See Pézier/White (2006).

[390] Some households might – in dependence of their investment goal – prefer return distributions with negative skewness and excess kurtosis. This, however, should be the minority and, additionally, it seems unlikely that households would design their entire speculation-portfolio with negative skewness and excess kurtosis, e.g., it is more likely that households invest small amounts of their wealth in lottery tickets to reach this effect.

is not critical for the performance evaluation[391], even when returns are not normally distributed.[392]

Due to the rebalancing strategies possibly not providing the same benefits for different speculation-portfolios with different asset allocation, linear regression analyses with the speculation-portfolio's asset class weights as independent variables are employed to analyze the asset class weights' influence on the benefits of the rebalancing strategies - measured as increase of the Sharpe-Ratio and increase of the gain factor of the Adjusted Sharpe-Ratio. The dependent variables of the regression analyses are the change of the Sharpe-Ratio ($\triangle SR_h$) and the change of the gain factor of the Adjusted Sharpe-Ratio of household h ($\triangle ASRFactor_h$) resulting from the usage of rebalancing strategies instead of a buy-and-hold strategy. The respective linear regression models are as follows.

$$\triangle SR_h = \beta_0 + \beta_1 * MoneyMarket_h + \beta_2 * Stocks_h + \beta_3 * Bonds_h + \beta_4 * RealEstateFunds_h \, \beta_5 * ArticlesOfGreatValue_h + \varepsilon \quad (10)$$

with

$MoneyMarket_h$ as percentage invested in cash(-equivalents);

$Stocks_h$ as percentage invested in stocks;

$Bonds_h$ as percentage invested in bonds;

$RealEstateFunds_h$ as percentage invested in real estate funds;

$ArticlesOfGreatValue_h$ as percentage invested in articles of great value.

$$\triangle ASRFactor_h = \beta_0 + \beta_1 * MoneyMarket_h + \beta_2 * Stocks_h + \beta_3 * Bonds_h + \beta_4 * RealEstateFunds_h + \beta_5 * ArticlesOfGreatValue_h + \varepsilon \quad (11)$$

Since households' asset allocation is significantly driven by households' characteristics, it seems possible that some households with certain socioeconomics and sociodemographics can expect higher benefits from rebalancing strategies than

[391] See Eling (2008) and Dichtl et al. (2016).
[392] See Adcock et al. (2012).

the remaining households. The following linear regression models are used to analyze this relation and to derive stylized characteristics of the households that would have benefitted from rebalancing their speculation-portfolio.

$$\begin{aligned}\Delta\, SR_h \;=\; & \beta_0 + \beta_1 * lnValueSP_h + \gamma_1 * RiskAtt_h + \beta_2 * Age_h \\ & + \beta_3 * Age^2{}_h + \beta_4 * Female_h + \beta_5 * lnTWealth_h \\ & + \beta_6 * lnIncome_h + \beta_7 * Child_h + \varepsilon \end{aligned} \tag{12}$$

with

$lnValueSP_h$ as logarithmized value of the speculation-portfolio of households h;
$RiskAtt_h$ as vector of households' self-reported financial risk attitude with the manifestations "no risk", "average risk", "above average risk" each with a commensurate return where "average risk" is the vector's basis;[393]
Age_h as age of the households' FKP;
$Female_h$ as 1 if the household's FKP is female and 0 if the household's FKP is male;
$lnTWealth_h$ as the household's logarithmized total wealth;
$lnIncome_h$ as the household's logarithmized monthly net income;
$Child_h$ as 1 if at least one person of 16 years or younger lives in the household and 0 otherwise.

$$\begin{aligned}\Delta\, ASRFactor_h \;=\; & \beta_0 + \beta_1 * lnValueSP_h + \gamma_1 * RiskAtt_h + \beta_2 * Age_h \\ & + \beta_3 * Age^2{}_h + \beta_4 * Female_h + \beta_5 * lnTWealth_h \\ & + \beta_6 * lnIncome_h + \beta_7 * Child_h + \varepsilon \end{aligned} \tag{13}$$

[393] This variable includes both items HD1800 and DHD2800. "above average risk" merges households that answered question HDI1800 or DHD2800 with "substantial" or "above average" financial risks due to the small amount of households that choose the answer "substantial".

7.2 Results

7.2.1 Comparison of portfolio performance resulting from buy-and-hold and rebalancing strategies

The mean μ and σ of households' speculation portfolios when households would have applied a buy-and-hold strategy are compared in Table 20 with the μ and σ of the speculation-portfolio when households would have applied a rebalancing strategy.

By employing a buy-and-hold strategy, households' speculation-portfolios would have earned an annual mean μ of 6.3 percent (median: 5.7 percent). When households had applied a periodical rebalancing strategy to adjust their portfolio on a monthly or an annual basis, their mean annual μ would have decreased by .05 or .15 percent, respectively. These decreases are statistically significant at the one-percent level, although the median return delta is zero. The threshold rebalancing strategies on average lead to 55 (5%-divergence strategy, which is that the portfolio is rebalanced when the worst and best performing asset classes' returns in a household's portfolio diverge by 5 percent compared to the last rebalancing/the beginning of the observation period), 15 (10%-divergence), or 4 (20%-divergence) portfolio adjustments within the four-year period. While the 5%-divergence strategy would have earned almost the same returns as the buy-and-hold strategy, the 10%- and 20%-divergence strategy would have yielded an annual mean μ that is .06 to .07 percent lower than the annual mean μ of the buy-and-hold strategy. The two latter differences are statistically significant at the one-percent level.

However, households might not assess the reduced μ from rebalancing strategies as negative if the portfolio risk σ was simultaneously reduced in a commensurable way. When households had pursued a buy-and-hold strategy, their mean annual σ would have been 7.9 percent (median: 7.0 percent). Except for the 20%-divergence strategy, the application of rebalancing strategies would have decreased the annual mean σ by .02 to .14 percent compared to the buy-and-hold strategy. Taken together, rebalancing on average would have led to lower annual μ combined with a lower mean annual σ.

Table 20: Portfolio outcomes of rebalancing strategies compared to buy-and-hold-strategy over a 4 year period

Annual μ Buy-and-hold strategy		Delta annual μ compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.0627	Mean	-.0005***	-.0015***	.0002	-.0006***	-.0007***
20%	.033	20%	-.003	-.004	-.003	-.003	-.003
Median	.057	Median	.000	.000	.001	.000	.000
80%	.089	80%	.002	.000	.003	.002	.002
Std.	.033	Std.	.003	.003	.003	.003	.003
Annual σ Buy-and-hold strategy		Delta annual σ compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.0792	Mean	-.0007***	-.0014***	-.0002*	-.0002***	.0003***
20%	.031	20%	-.004	-.003	-.003	-.003	-.002
Median	.070	Median	.000	-.001	.000	.000	.001
80%	.127	80%	.002	.000	.002	.003	.003
Std.	.051	Std.	.003	.002	.003	.003	.003

Notes: The table provides the mean value (Mean), 20-percent percentiles (20%), median value (Median), 80-percent percentiles (80%), and standard deviations (Std.) of the differences of the annual return (μ) and annual standard deviation of returns (σ) between a buy-and-hold strategy and the outcomes of a rebalancing strategy for the same portfolios. Next to the mean values, the table provides the results of parametric t-tests that test whether the mean values differ from 0 at statistically significant levels. The symbols *** and * denote statistical significance at the one- and ten-percent level, respectively. Example: The portfolios achieve a .05 percent lower mean return with monthly rebalancing strategies than with a buy-and-hold strategy. The lower mean return is different from zero with a statistical significance at the one-percent level.

The on average simultaneous decrease of portfolios' σ and μ through rebalancing strategies does not yet answer the question whether these strategies enhance portfolio efficiency, because the majority of the outcomes of the rebalanced portfolios would not have dominated (i.e. have a higher μ while the σ stays stable or an at least equal μ while the σ decreases) the outcomes of the buy-and-hold strategies and vice versa.[394] Therefore, the further analysis focuses on the change of the speculation-portfolios' Sharpe-Ratio and Adjusted Sharpe-Ratio caused by portfolio rebalancing. The respective results are presented in Table 21. The mean Sharpe-Ratio of households' speculation-portfolios would have been .697 (median: .690) when households had pursued a buy-and-hold strategy. Using a rebalancing strategy instead reveals no clear effect. The monthly and 5%-divergence rebalancing strategies on average would have improved the Sharpe-Ratio by .006 and .012 compared to the buy-and-hold-strategy, respectively. In contrast, the annual and

[394] See Appendix G Table 46 for detailed results.

20%-divergence strategy would have reduced the Sharpe-Ratio by .003 and .008, respectively.

Measuring the portfolio performance with the Adjusted Sharpe-Ratio leads to clearer results. The mean (median) Adjusted Sharpe-Ratio of the buy-and-hold strategy is .630 (626). All rebalancing strategies undercut this value by .009 to .019. The difference between the mean Adjusted Sharpe-Ratio of the buy-and-hold strategy and the mean Adjusted Sharpe-Ratios of the rebalancing strategies is statistically significant at the one-percent level for all rebalancing strategies. This means that employing rebalancing strategies would have led to a less favorable skewness and kurtosis of the return distribution from a risk averse investor's view.

Table 21: Portfolio outcomes of rebalancing strategies compared to buy-and-hold-strategy over a 4 year period

Sharpe-Ratio Buy-and-hold strategy		Delta Sharpe-Ratio compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.697	Mean	.006***	-.003***	.012***	.001	-.008***
20%	.471	20%	-.010	-.023	-.004	-.017	-.027
Median	.690	Median	.000	.000	.007	-.001	-.006
80%	.914	80%	.020	.013	.028	.017	.008
Std.	.235	Std.	.030	.031	.031	.030	.028
Adjusted Sharpe-Ratio Buy-and-hold strategy		Delta Adjusted Sharpe-Ratio compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.630	Mean	-.009***	-.018***	-.010***	-.017***	-.019***
20%	.453	20%	-.031	-.048	-.035	-.038	-.044
Median	.626	Median	-.002	-.000	.001	-.008	-.009
80%	.804	80%	.013	.012	.018	.005	.005
Std.	.189	Std.	.189	.054	.044	.038	.039

Notes: The table provides the mean value (Mean), 20-percent percentiles (20%), median value (Median), 80-percent percentiles (80%), and standard deviations (Std.) of the differences of the Sharpe-Ratio and Adjusted Sharpe-Ratio between a buy-and-hold strategy and the outcomes of a rebalancing strategy for the same portfolios. Next to the mean values, the table provides the results of parametric t-tests that test whether the mean values differ from 0 at statistically significant levels. The symbol *** denotes statistical significance at the one-percent level. Example: The portfolios achieve a .006 higher mean Sharpe-Ratio with monthly rebalancing strategies than with a buy-and-hold strategy. The higher mean Sharpe-Ratio is different from zero with a statistical significance at the one-percent level.

Although the rebalancing strategies, on average, would have resulted in statistically significant different portfolio outcomes compared to a buy-and-hold strategy, the economic differences are rather negligible for the households. Since rebalancing, on

average, would not have enhanced the (Adjusted) Sharpe-Ratios at a statistically significant level before transaction costs, it is clear that the rebalancing strategies would have had no positive effect after transaction costs. Therefore, no additional analysis with transaction costs is provided at this stage.

7.2.2 The relation between the initial asset allocation and the benefits from portfolio rebalancing

Since the success of a rebalancing strategy is likely to depend on the initial asset allocation, the sample of 830 speculation-portfolios is divided in portfolios that would have benefitted from rebalancing (i.e., the winners) and portfolios that would have suffered from rebalancing (i.e. the losers) to identify significant differences between the two subsamples' asset class weights. This analysis enables to derive stylized key features of the composition of portfolios that would have enhanced/decreased their performance through rebalancing.

The mean (median) asset class weights of speculation-portfolios that would have benefitted/suffered from rebalancing, measured by the increase/decrease of their Sharpe-Ratio, are provided in Table 22. By and large, the analysis reveals a similar pattern over all five rebalancing strategies. Speculation-portfolios whose Sharpe-Ratio would have been enhanced through rebalancing on average consist of roughly 40 percent investments in *money market*, 25 to 34 percent *stocks*, 13 percent *bonds*, 5 to 9 percent *real estate funds*, and 2 to 12 percent *articles of great value*. Portfolios that would have suffered from rebalancing show a significantly higher proportion of investments in *money market* (46 to 50 percent) and *articles of great value* (15 to 22 percent) and a significantly lower share of *stocks* (13 to 24 percent) and *real estate funds* (2 percent). The portfolio weight of bonds is not statistically different between both subsamples. In a buy-and-hold-scenario, the portfolios that suffered from rebalancing, on average, would have clearly outperformed (both with a higher μ and lower σ) the remaining portfolios that would have benefitted from rebalancing. This means that households that have chosen a more efficient initial asset allocation for their speculation-portfolio (because they invested a larger portfolio share in the outperforming asset class *articles of great value*) would have been more likely to suffer from rebalancing, i.e. show a decline of their Sharpe-Ratio, than households that choose a less efficient initial investment policy.

Table 22: Portfolio composition of winners and losers of rebalancing (Sharpe-Ratio)

Panel A: Periodical rebalancing strategies

	Monthly rebalancing			Annual rebalancing		
	Enhanced SR_h	Reduced SR_h	Sig.	Enhanced SR_h	Reduced SR_h	Sig.
Mean (median) asset class portfolio weight						
Money market	.392 (.346)	.504 (.531)	***	.430 (.446)	.461 (.459)	
Stocks	.317 (.256)	.167 (.039)	***	.344 (.317)	.174 (.032)	***
Bonds	.136 (.000)	.123 (.000)		.124 (.000)	.134 (.000)	
Real estate funds	.062 (.000)	.021 (.000)	***	.085 (.000)	.012 (.000)	***
Articles of great value	.093 (.000)	.186 (.049)	***	.018 (.000)	.219 (.122)	***
Mean annual μ (buy-and-hold)	.061	.065	*	.055	.068	***
Mean annual σ (buy-and-hold)	.086	.072	***	.080	.079	
N	409	421		326	504	

Panel B: Threshold rebalancing strategies

	5%-Divergence rebalancing			10%-Divergence rebalancing			20%-Divergence rebalancing		
	Enhanced SR_h	Reduced SR_h	Sig.	Enhanced SR_h	Reduced SR_h	Sig.	Enhanced SR_h	Reduced SR_h	Sig.
Mean (median) asset class portfolio weight									
Money market	.421 (.395)	.497 (.531)	***	.412 (.380)	.468 (.488)	**	.400 (.355)	.470 (.484)	***
Stocks	.308 (.244)	.126 (.000)	***	.247 (.169)	.236 (.131)		.340 (.272)	.200 (.088)	***
Bonds	.129 (.000)	.131 (.000)		.132 (.000)	.129 (.000)		.133 (.000)	.129 (.000)	
Real estate funds	.050 (.000)	.025 (.000)	***	.087 (.000)	.013 (.000)	***	.093 (.000)	.020 (.000)	***
Articles of great value	.092 (.000)	.222 (.123)	***	.117 (.000)	.154 (.000)	**	.038 (.000)	.182 (.043)	***
Mean annual μ (buy-and-hold)	.060	.068	***	.059	.065	***	.054	.066	***
Mean annual σ (buy-and-hold)	.083	.072	***	.080	.079		.083	.078	
Mean #rebalances	60	47	***	16	14	***	5	4	***
N	524	306		313	517		240	590	

Notes: The table provides the mean and median (in parentheses) portfolio weights of each asset class for speculation-portfolios that show an enhanced/reduced Sharpe-Ratio by employing a rebalancing strategy instead of employing a buy-and-hold strategy as well as the mean annual μ and mean annual σ that the portfolios would achieve with a buy-and-hold strategy. It is differentiated between periodical (Panel A) and threshold rebalancing strategies (Panel B). The table provides the results of parametric t-tests that test whether an asset class's mean portfolio weight in the portfolios that show an enhanced Sharpe-Ratio by employing a rebalancing strategy (i.e. the winners) differ from an asset class's mean portfolio weight in the portfolios that show a reduced Sharpe-Ratio by employing a rebalancing strategy (i.e. the losers) at statistically significant levels. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: The 409 speculation-portfolios that show an enhanced Sharpe-Ratio by employing a monthly rebalancing strategy have on average, 39.2 percent of their portfolio value invested in *money market* while the 421 portfolios that show a reduced Sharpe-Ratio by employing a monthly rebalancing strategy have on average 50.4 percent of their portfolio value invested in *money market*. Both mean values differ from each other with a statistical significance at the one-percent level.

In addition to the Sharpe-Ratio, households might also be interested in the skewness and kurtosis of their speculation-portfolios' return distribution. These measures are

captured in the penalty/gain factor of the Adjusted Sharpe-Ratio (ASR-Factor). The 830 speculation-portfolios are again split in a subsample with portfolios that would have benefitted from rebalancing (i.e., the winners with a higher ASR-Factor) and a subsample with portfolios that would have suffered from rebalancing (i.e., the losers with a lower ASR-Factor). The mean (median) asset class weights of both subsamples are provided in Table 23. Once more, the losers have a higher percentage invested in *money market* and *articles of great value*. In contrast to the previous results, there is no longer a clear picture regarding the role of *stocks*. Furthermore, both subsamples of portfolios show roughly the same percentage invested in *real estate funds*. However, portfolios that would have improved their ASR-Factor through rebalancing have a significantly higher percentage in *bonds* (between 16 and 38 percent). Due to the bonds' relatively low μ and σ the latter result should moreover be the cause why the winners show a lower μ and lower σ in a buy-and-hold scenario than the losers.

Table 23: Portfolio composition of winners and losers of rebalancing (ASR-Factor)

Panel A: Periodical rebalancing strategies

	Monthly Rebalancing			Annual Rebalancing		
	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.
Mean (Median) asset class portfolio weight						
Money market	.380 (.326)	.463 (.477)	***	.414 (.420)	.466 (.479)	***
Stocks	.269 (.121)	.234 (.153)		.375 (.338)	.173 (.052)	***
Bonds	.292 (.243)	.096 (.000)	***	.155 (.046)	.117 (.000)	**
Real estate funds	.019 (.000)	.046 (.000)	**	.027 (.000)	.048 (.000)	**
Articles of great value	.040 (.000)	.161 (.025)	***	.029 (.000)	.196 (.093)	***
Mean annual μ (buy-and-hold)	.046	.066	***	.054	.067	***
Mean annual σ (buy-and-hold)	.069	.081	***	.084	.077	*
N	144	686		277	553	

Panel B: Threshold rebalancing strategies

	5%-Divergence Rebalancing			10%-Divergence Rebalancing			20%-Divergence Rebalancing		
	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.
Mean (Median) asset class portfolio weight									
Money market	.382 (.425)	.456 (.460)	**	.360 (.343)	.456 (.462)	**	.378 (.346)	.471 (.486)	***
Stocks	.154 (.000)	.248 (.161)	**	.190 (.016)	.244 (.159)		.300 (.210)	.222 (.138)	***
Bonds	.382 (.336)	.107 (.000)	***	.331 (.285)	.114 (.000)	***	.243 (.156)	.094 (.000)	***
Real estate funds	.018 (.000)	.043 (.000)		.031 (.000)	.042 (.000)		.033 (.000)	.044 (.000)	
Articles of great value	.063 (.000)	.147 (.000)	***	.088 (.000)	.144 (.000)	*	.048 (.000)	.169 (.033)	***
Mean annual μ (buy-and-hold)	.046	.064	***	.052	.064	***	.049	.067	***
Mean annual σ (buy-and-hold)	.053	.082	***	.064	.080	**	.076	.080	
Mean #rebalances	30	57	***	9	15	***	3	4	***
N	69	761		60	770		198	632	

Notes: The table provides the mean and median (in parentheses) portfolio weights of each asset class for speculation-portfolios that show an enhanced/reduced Adjusted Sharpe-Ratio Factor (ASR-Factor) by employing a rebalancing strategy instead of employing a buy-and-hold strategy as well as the mean annual μ and mean annual σ that the portfolios would achieve with a buy-and-hold strategy. It is differentiated between periodical (Panel A) and threshold rebalancing strategies (Panel B). The table provides the results of parametric t-tests that test whether an asset class's mean portfolio weight in the portfolios that show an enhanced ASR-Factor by employing a rebalancing strategy (i.e. the winners) differ from an asset class's mean portfolio weight in the portfolios that show a reduced ASR-Factor by employing a rebalancing strategy (i.e. the losers) at statistically significant levels. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: The 144 portfolios that show an enhanced ASR-Factor by employing a monthly rebalancing strategy have on average 38.0 percent of their portfolio value invested in *money market* while the 686 portfolios that show a reduced ASR-Factor by employing a monthly rebalancing strategy have on average 46.3 percent of their portfolio value invested in *money market*. Both mean values differ from each other with a statistical significance at the one-percent level.

Furthermore, regression analyses using the model of equation (10) are performed with the speculation-portfolios' asset class weights as independent variables and the Sharpe-Ratio increase/decrease caused by rebalancing as dependent variables. The regression analyses account for interdependencies between the speculation-portfolios' asset class weights, which helps to isolate the influence of each asset's share on the variation of the Sharpe-Ratio.

The results of the regression analysis are presented in Table 24 and support the conclusions from the previous analyses. Rebalancing would have led to a stronger increase of the speculation-portfolios' Sharpe-Ratio the higher the initial weight of *stocks* and *real estate funds* was. As can be derived from the regression analysis, this is also the case for a higher weight of *bonds*. In contrast, the speculation-portfolios would have suffered more strongly from rebalancing when including a higher percentage of *articles of great value*. Values of the regression analyses' (adjusted) R-squared furthermore show that the investment policy in households' speculation-portfolio explains a higher proportion of the rebalancing induced changes of the Sharpe-Ratios for strategies with lower rebalancing frequency, i.e. annual and 20%-divergence rebalancing. Since these two strategies are the only ones with a statistically significant negative impact on the household portfolios' Sharpe-Ratios, the regression analyses seem to provide more explanatory power regarding the investment policy of speculation-portfolios that would have suffered from rebalancing than the investment policy of speculation-portfolios that would have gained from rebalancing.

Table 24: Influence of households' investment policy on the success of rebalancing strategies measured as increase in Sharpe-Ratio ($\triangle SR_h$) over a 4 year period

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Money market	Omitted	Omitted	Omitted	Omitted	Omitted
Stocks	.007 (.004)	.021*** (.004)	-.005 (.005)	-.001 (.004)	.030*** (.004)
Bonds	.017*** (.005)	.019*** (.005)	.007 (.005)	.016*** (.005)	.035*** (.005)
Real estate funds	.026*** (.008)	.057*** (.008)	-.000 (.009)	.039*** (.009)	.060*** (.007)
Articles of great value	-.015*** (.005)	-.026*** (.005)	-.027*** (.005)	-.004 (.005)	-.005 (.005)
β_0	.003 (.002)	-.010*** (.002)	.016*** (.002)	-.001 (.002)	-.022*** (.002)
R^2	.054	.174	.045	.041	.190
R^2 adj.	.049	.170	.040	.036	.186
F-Test	11.680	43.393	9.618	8.786	48.252
VIF (highest value among all independent variables)	1.412	1.412	1.412	1.412	1.412

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R^2, adjusted R^2 (R^2 adj.), and F-statistics (F-Test), and VIF for the regression analysis using equation (10) with the increase of the Sharpe-Ratio resulting from the usage of rebalancing strategies instead of a buy-and-hold strategy as dependent variable. The symbol *** denotes statistical significance at the one-percent level. Example: Regressing the increase of the Sharpe-Ratio of households' speculation-portfolios with a monthly rebalancing strategy on the model of equation (10) yields a coefficient of the percentage of stocks in the portfolio of .007 with no statistical significance and an adjusted R^2 of .049.

The influence of the assets class weights on the change of the speculation-portfolios' ASR-Factor caused by rebalancing is analyzed using the model of equation (11). The respective results in Table 25 show that rebalancing would have led to a higher ASR-Factor for portfolios with higher weights of *stocks*, *bonds*, and *real estate funds*. The percentage of *articles of great value* hardly has a statistically significant influence on the change of the ASR-Factor. Compared to the regression analyses regarding the remaining four strategies, the regression analysis for the annual rebalancing shows an at least 17 percentage points lower adjusted R-squared of .082. The reasons for this effect are, however, hardly assessable with the data of this study and remain subject for further research.

Table 25: Influence of households' investment policy on the success of rebalancing strategies measured as increase in ASR-Factor ($\triangle ASRFactor_h$) over a 4 year period

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Money market	Omitted	Omitted	Omitted	Omitted	Omitted
Stocks	.047*** (.003)	.068*** (.009)	.067*** (.004)	.057*** (.004)	.039*** (.003)
Bonds	.031*** (.004)	.052*** (.010)	.046*** (.005)	.040*** (.005)	.029*** (.003)
Real estate funds	.033*** (.007)	.051*** (.017)	.040*** (.009)	.040*** (.008)	.029*** (.006)
Articles of great value	-.003 (.004)	.024** (.010)	-.006 (.005)	.000 (.005)	-.003 (.003)
β_0	-.032*** (.002)	-.046*** (.004)	-.046*** (.002)	-.041*** (.002)	-.027*** (.001)
R^2	.256	.086	.310	.274	.275
R^2 adj.	.252	.082	.307	.271	.271
F-Test	70.976	19.496	92.768	77.961	78.232
VIF (highest value among all independent variables)	1.412	1.412	1.412	1.412	1.412

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R^2, adjusted R^2 (R^2 adj.), and F-statistics (F-Test), and VIF for the regression analysis using equation (11) with the increase of the Adjusted Sharpe-Ratio Factor (ASR-Factor) resulting from the usage of rebalancing strategies instead of a buy-and-hold strategy as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing the increase of the ASR-Factor of households' speculation-portfolios with a monthly rebalancing strategy on the model of equation (11) yields a coefficient of the percentage of stocks in the portfolio of .047 with a statistical significance at the one-percent level and an adjusted R^2 of .252.

Taken together, the results reveal that households whose portfolio largely consists of *stocks*, *bonds*, and *real estate funds* could have increased their portfolio performance through rebalancing on the one hand. On the other hand, households that initially invested a higher percentage of their portfolio in *articles of great value* would have suffered from rebalancing.

7.2.3 The relation between households' characteristics and the benefits from portfolio rebalancing

So far, the findings have shown that the investment policy in households' speculation-portfolio is significantly responsible for households' profits and drawbacks from portfolio rebalancing. However, households' investment policy might

in turn be driven by households' socioeconomics and sociodemographics. Therefore, it seems possible that the benefits of rebalancing might also depend on these household characteristics, yet only under the precondition that the investment policy of the households in the sample is driven by their characteristics.

The existence of this relation is checked by regression analyses with households' socioeconomics and sociodemographics as independent variables and the portfolio share of the five asset classes *money market*, *stocks*, *bonds*, *real estate funds* and *articles of great value* as dependent variables. The results of the regression analyses in Table 26 show that households' investment policy is significantly driven by the value of their speculation-portfolio and their self-reported risk attitude. Specifically, households increase the weights of *stocks*, *bonds*, and *real estate funds* when their speculation-portfolio gets more valuable. At the same time, the percentages invested in *articles of great value* and *money market* decrease with a higher portfolio value.

In addition, households that are willing to take above average financial risks hold portfolios with a lower percentage of investments in *money market* and *articles of great value* and a higher percentage of *stocks* than households with an average willingness to take financial risks. Vice versa, households that are not willing to take financial risks invest a lower percentage in *stocks* and a higher percentage in *money market* and *articles of great value* than households with an average willingness to take financial risks.

Households' stock holdings are also influenced by the gender of the FKP. Households with a female FKP hold a smaller percentage of their speculation-portfolio in *stocks* than households with a male FKP. The portfolio share invested in *real estate funds* decreases with higher income. Taken together, the regression analyses provide statistically significant support that the asset allocation in households' speculation-portfolio is driven by households' characteristics.

Table 26: Influence of households' characteristics on the asset class weights in households' speculation-portfolio

	Money market	Stocks	Bonds	Real estate funds	Articles of great value
$lnValueSP_h$	-.036*** (.010)	.016* (.009)	.034*** (.008)	.008* (.004)	-.021** (.008)
$AboveAverageRisk_h$	-.167*** (.043)	.270*** (.040)	-.019 (.033)	-.014 (.019)	-.071** (.036)
$NoRisk_h$	.062*** (.021)	-.122*** (.020)	.006 (.016)	-.007 (.009)	.060*** (.018)
Age_h	.002 (.004)	-.004 (.004)	.001 (.003)	.002 (.002)	-.002 (.004)
$Age^2{}_h$	-.000 (.000)	.000 (.000)	-.000 (.000)	-.000 (.000)	.000 (.000)
$Female_h$	-.002 (.020)	-.044** (.019)	.011 (.016)	.008 (.009)	.027 (.017)
$lnTWealth_h$	.012 (.010)	.009 (.009)	.001 (.008)	.001 (.004)	-.023*** (.008)
$lnIncome_h$	.003 (.020)	-.016 (.019)	-.003 (.016)	-.021** (.009)	.037** (.017)
$Child_h$	.025 (.029)	.027 (.028)	-.005 (.023)	-.018 (.013)	-.029 (.025)
β_0	.664*** (.163)	.231 (.154)	-.303** (.127)	.043 (.074)	.365*** (.138)
R²	.075	.146	.056	.026	.071
R² adj.	.064	.136	.045	.015	.061
F-Test	7.316	15.490	5.329	2.398	6.907

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R², adjusted R^2 (R² adj.), and F-statistics (F-Test) for the regression analysis with the weights of the asset classes *money market*, *stocks*, *bonds*, *real estate funds*, and *articles of great value* in households' speculation-portfolio as dependent variables and households' sociodemographics and -economics as independent variables. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing the percentage of stocks in households' speculation-portfolio on households' sociodemographics and -economics yields a coefficient of household's logarithmized speculation-portfolio value ($lnValueSP_h$) of .016 with a statistical significance at the ten-percent level and an adjusted R² of .136.

The relation between the asset allocation in households' speculation-portfolio and households' characteristics might indicate a possible link between households' characteristics and the benefits/disadvantages from rebalancing their speculation-portfolio. Linear regression analyses using model (12) are employed to investigate whether such a link between the households' characteristics and households' Sharpe-Ratio gains/losses exists. The respective results are presented in Table 27. However, the adjusted R²s of the regression analyses do not exceed 2.8 percent

and, therefore, reveal that a possible relation between households' characteristics and the benefits from rebalancing is only very weak or not existent. The only household characteristic with a statistically significant influence at the one-percent level is the value of households' speculation-portfolio. Households with a more valuable portfolio could have slightly increased their Sharpe-Ratio if they had used a periodical rebalancing strategy. But the regression coefficients are so small that an economically significant effect can hardly be expected.

Table 27: Influence of households' characteristics on the success of rebalancing strategies measured as increase in Sharpe-Ratio (△SR) over a 4 year period

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
$lnValueSP_h$	.002**	.003***	.002	.001	.003***
	(.001)	(.001)	(.001)	(.001)	(.001)
$AboveAverageRisk_h$	-.002	.000	-.006	-.003	.000
	(.005)	(.005)	(.005)	(.005)	(.004)
$NoRisk_h$	-.001	-.005**	-.005*	-.001	-.006
	(.002)	(.002)	(.002)	(.002)	(.002)
Age_h	-.001	.000	.000	.000	.000
	(.000)	(.000)	(.000)	(.000)	(.000)
$Age^2{}_h$	.000	-.000	.000	.000	.000
	(.000)	(.000)	(.000)	(.000)	(.000)
$Female_h$	-.003	-.003	-.002	-.002	-.004*
	(.002)	(.002)	(.002)	(.002)	(.002)
$lnTWealth_h$	.001	.001	-.000	.000	.000
	(.001)	(.001)	(.001)	(.001)	(.001)
$lnIncome_h$	-.001	-.003	.001	.000	-.002
	(.002)	(.002)	(.002)	(.002)	(.002)
$Child_h$	-.002	-.001	.000	-.003	.002
	(.003)	(.003)	(.003)	(.003)	(.003)
β_0	-.001	-.025	.007	-.004	-.011
	(.018)	(.019)	(.019)	(.019)	(.017)
R²	.018	.036	.021	.007	.038
R² adj.	.007	.025	.010	-.004	.028
F-Test	1.673	3.361	1.921	.661	3.623

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R², adjusted R^2 (R² adj.), and F-statistics (F-Test) for the regression analysis using equation (12) with the increase of the Sharpe-Ratio resulting from the usage of rebalancing strategies instead of a buy-and-hold strategy as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing the increase of the Sharpe-Ratio of households' speculation-portfolios with a monthly rebalancing strategy on the model of equation (12) yields a coefficient of household's logarithmized portfolio value ($lnValueSP_h$) of .002 with a statistical significance at the five-percent level and an adjusted R² of .007.

By employing equation (13) as model in a linear regression analysis it is analyzed whether households' characteristics are related to the effect of rebalancing on their speculation-portfolios' return distribution, i.e. their ASR-Factor. The results of the regression analysis in Table 28 show that only two household characteristics have a statistically significant influence on the changes of the ASR-Factor caused by rebalancing, namely the value of households' speculation-portfolio and households' willingness to take financial risk. The higher the value of households' speculation-portfolio the higher is their chance that the ASR-Factor of their portfolio would have risen by employing rebalancing strategies. Households that state to not be willing to take financial risks are less likely to increase their ASR-Factor by the application of rebalancing strategies. The adjusted R^2s of the regression analyses show that households' characteristics rather have predictive power regarding the change of the ASR-Factor than regarding the change of the Sharpe-Ratio that is induced by the usage of rebalancing strategies.

Table 28: Influence of households' characteristics on the success of rebalancing strategies measured as increase in ASR-Factor (△ASRFactor) over a 4 year period

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
$lnValueSP_h$	.002** (.001)	.001 (.002)	.003** (.001)	.003 (.001)	.002*** (.001)
$AboveAverageRisk_h$	.005 (.004)	.012 (.010)	.008 (.006)	.007 (.005)	.004 (.003)
$NoRisk_h$	-.009*** (.002)	-.005 (.005)	-.012*** (.003)	-.010*** (.002)	-.007*** (.002)
Age_h	.000 (.000)	-.001 (.001)	.000 (.001)	.000 (.000)	.000 (.000)
$Age^2{}_h$	-.000 (.000)	.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
$Female_h$	-.002 (.002)	-.002 (.004)	-.003 (.003)	-.002 (.002)	-.001 (.002)
$lnTWealth_h$	.000 (.001)	.001 (.002)	.000 (.001)	.000 (.001)	.000 (.001)
$lnIncome_h$	-.001 (.002)	.004 (.004)	-.001 (.003)	.000 (.002)	-.001 (.002)
$Child_h$	.003 (.003)	-.001 (.007)	.005 (.004)	.001 (.003)	.002 (.002)
β_0	-.037 (.016)	-.057 (.037)	-.050** (.021)	-.048** (.019)	-.041*** (.013)
R^2	.055	.011	.066	.059	.071
R^2 adj.	.045	.000	.056	.049	.060
F-Test	5.314	.996	6.435	5.724	3.895

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R^2, adjusted R^2 (R^2 adj.), and F-statistics (F-Test) for the regression analysis using equation (13) with the increase of the Adjusted Sharpe-Ratio Factor (ASR-Factor) resulting from the usage of rebalancing strategies instead of a buy-and-hold strategy as dependent variable. The symbols *** and ** denote statistical significance at the one- and five-percent level, respectively. Example: Regressing the increase of the ASR-Factor of households' speculation-portfolios with a monthly rebalancing strategy on the model of equation (13) yields a coefficient of household's logarithmized portfolio value ($lnValueSP_h$) of .002 with a statistical significance at the five-percent level and an adjusted R^2 of .045.

Nevertheless, it is hardly tenable to state that one could predict the benefits of portfolio rebalancing just by knowing a household's socioeconomics and sociodemographics or, in turn, that a subsample of households with certain socioeconomics and sociodemographics benefits/suffers most from rebalancing strategies. In combination with the previous results regarding the average impact of rebalancing on the performance of households' speculation-portfolio, the application

of rebalancing strategies would not have led to a significant increase in portfolio efficiency in the analyzed sample and observation period.

7.2.4 Robustness Checks

Rebalancing constitutes a dynamic trading strategy. Consequently, the performance of these strategies is highly path-dependent.[395] Therefore, the previous results may be influenced by specific characteristics of the benchmarks' returns in the observation period. Since data of the PHF-survey were collected over an 11-month period, path-dependence can partially be controlled by using different starting points for the performance analysis. For this purpose, the dataset is subdivided accordingly to the quarter when households were interviewed and the analysis is repeated for each subsample.[396] This method, furthermore, allows to check whether the previous results are driven by some households that were interviewed in a specific quarter. Although the subsamples' results show some discrepancies (e.g., a higher percentage of households, which were interviewed in the fourth quarter of 2010, would have benefitted from rebalancing than in the other two subsamples), in none of the subsamples, rebalancing strategies would have led to an economically significant positive or negative shift of the efficiency of households' speculation-portfolios.

There are no previous studies known that include the asset classes *real estate funds* and *articles of great value* in a rebalancing strategy. Since these two asset classes outperform *stocks* in some periods of the observation period, the role of these two assets is analyzed in greater detail. More specifically, the focus lies on the subsample of households that do not invest in these assets to see how much the results depend on the development of the asset classes *real estate funds* and *articles of great value*. The Sharpe-Ratio gains and Adjusted Sharpe-Ratio gains induced by rebalancing strategies in speculation-portfolios without investments in *real estate funds* and *articles of great value* are presented in Table 29. Compared to the full sample, the speculation-portfolios in this subsample would have benefited slightly more from rebalancing. However, the Sharpe-Ratio gains are hardly economically significant, although, they are statistically significant for some strategies. This means

[395] See Dichtl et al. (2016).
[396] See Appendix H and Appendix I for the detailed results of these analyses.

that the overall results are not primarily driven by the performance of the *real estate funds*- and *articles of great value*-benchmarks but, instead, also hold for households not investing in these asset classes.

Table 29: Portfolio outcomes of rebalancing strategies compared to buy-and-hold-strategy over a 4 year period (only portfolios without investments in real estate funds and articles of great value, N=347)

Outcome Buy-and-hold strategy			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Sharpe-Ratio		Delta Sharpe-Ratio compared to buy-and-hold-strategy					
Mean	.549	Mean	.011***	.007***	.018***	.001	-.002
20%	.400	20%	-.001	.000	.000	-.014	-.027
Median	.612	Median	.002	.004	.011	.000	-.015
80%	.680	80%	.024	.015	.033	.008	.000
Std.	.196	Std.	.034	.030	.033	.033	.005
Adjusted Sharpe-Ratio		Delta Adjusted Sharpe-Ratio compared to buy-and-hold-strategy					
Mean	.490	Mean	.008***	.003**	.015***	-.002*	-.003***
20%	.396	20%	-.004	-.000	.001	-.018	-.019
Median	.495	Median	.002	.004	.009	-.002	-.001
80%	.563	80%	.019	.015	.029	.010	.008
Std.	.122	Std.	.023	.028	.022	.024	.019

Notes: The table provides the mean value (Mean), 20-percent percentiles (20%), median value (Median), 80-percent percentiles (80%), and standard deviations (Std.) of the differences of the Sharpe-Ratio and Adjusted Sharpe-Ratio between a buy-and-hold strategy and the outcomes of a rebalancing strategy for the same speculation-portfolios. Next to the mean values, the table provides the results of parametric t-tests that test whether the mean values differ from 0 at statistically significant levels. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: The speculation-portfolios achieve a .011 higher mean Sharpe-Ratio with monthly rebalancing strategies than with a buy-and-hold strategy. The higher mean Sharpe-Ratio is different from zero with a statistical significance at the one-percent level.

7.3 Discussion and Conclusion

Regarding RQ4, the empirical analysis of potential benefits from rebalancing strategies for households' speculation-portfolio shows that the analyzed households, on average, hardly would have benefited from such strategies compared to a buy-and-hold-strategy in the period from September 2010 to July 2015.

Although transaction costs and management fees may play a crucial role for the success of rebalancing strategies[397], they are not considered in the previous analyses. In the unpublished part of the analysis none of the analyzed households could have improved the Sharpe-Ratio of its speculation-portfolio with rebalancing strategies if annual fees had been exceed .4 percent of the portfolio value. Still, one

[397] See Almadi at al. (2014), Dayanandan/Lam (2015).

should not take such a threshold at face value, because as one limitation of the results asset markets were almost throughout in a bullish phase during the observation period. These market conditions are on principal more favorable for a buy-and-hold strategy[398], because if markets are that trendy, there is hardly a chance for a rebalancing strategy to buy past loser assets that will reverse in the future. Instead, assets that continue to go up are previously sold due to their past returns. Rebalancing strategies should perform better in times of more volatile asset markets which is why the previous empirical analysis may underestimate the benefits that could be achieved with rebalancing strategies through a whole economic cycle.

Nevertheless, the findings of this analysis clarify that portfolio rebalancing is not a silver bullet to boost portfolio efficiency.[399] In combination with the findings of Jacobs et al. (2014), who find that smaller shifts in portfolios' asset weights do not hamper portfolio efficiency as long as the portfolio is not tilted extremely towards one asset, the results support the implication of Tokat/Wikas (2007) that reasonable (e.g., yearly) monitoring frequencies and allocation thresholds are sufficient to control households' portfolio risk.

Regarding RQ5, some results of the empirical analysis show a statistically significant influence of the value of households' speculation-portfolio on the benefits of rebalancing strategies. Since, however, regression coefficients for the logarithmized value of the speculation-portfolio with the Sharpe-Ratio as dependent variable never exceed .003, an economically significant influence of households' wealth on the benefits from portfolio rebalancing is declinable.

[398] See Perold/Sharpe (1988).
[399] See also Dayanandan/Lam (2015) stating that "The hype associated with such strategies does not withstand the test of data in the long run" (p. 79).

8 Discussion and Overview of Results

The analyses in the previous chapters are, with the exception of Oehler/Horn/Wedlich (2018), the first that apply the Behavioral Portfolio Theory (BPT) on household-level field data. The aim of these analyses was twofold:

- To assess whether the BPT better explains households' actual portfolio choice than neoclassical portfolio choice models.
- To analyze households' portfolio performance within the framework of the BPT.

To meet these research aims, the analyses are based on foundations from the neoclassical framework as well as insights from the paradigms of new institutional economics, market microstructure, financial intermediation, and behavioral economics and finance. The empirical analyses are applied on data of 3,565 German households from the first wave of the PHF-Survey provided by Deutsche Bundesbank.

The analyses regarding the first aim were conducted along the two research questions RQ1 and RQ2.

> RQ1: Is the households' relative risk aversion (RRA) in their speculation-portfolio different from the RRA in their entire portfolio?

The analyzed households show decreasing RRA in both their speculation-portfolio and their entire portfolio. Hence, the results support previous findings of Cohn et al. (1975), Morin/Suarez (1983), Riley/Chow (1992), Oehler (1998a), Calvet/Sodini (2014), and Oehler/Horn/Wedlich (2018). Nevertheless, the influence of households' wealth either measured as total wealth or as value of the speculation-portfolio is less distinct for those households that actually invest in risky assets. For this subsample of households, all regression models considerably loose explanatory power. Hence, household wealth plays a minor role for the asset allocation in the subsample of households that invest in risky assets, while an increase in household wealth significantly raises the probability that households invest in risky assets. Both effects are, again, similar for the speculation-portfolio and the entire portfolio.

RQ2: Does the value of households' speculation-portfolio better explain the households' RRA in their speculation-portfolio than the households' total wealth explains the RRA in the entire portfolio?

After accounting for the explanatory power of household-specific characteristics, the value of households' speculation-portfolio adds more explanatory power regarding households' RRA in their speculation-portfolio than households' total wealth regarding households' RRA in their entire portfolio. With the exception of the models that analyze only the subsample of households investing in risky assets, all models that employ the value of the speculation-portfolio provide more explanatory power than the respective models that use households' total wealth as independent variable. However, as the concept of RRA generally applies on all households, the constraint that the latter effect cannot be observed for the subsample of households investing in risky assets plays a minor role.

The stepwise approach in the regression-analyses reveals that other household characteristics, e.g., households' directly queried risk attitude and the gender of the financial knowledgeable person (FKP), explain a significant proportion of households' investment policy. A possible interpretation of these findings is that households' total wealth and particularly the value of households' speculation-portfolio is of notable importance when households decide on whether to generally invest in risky assets. Yet, when households feel like they have accumulated a sufficient amount of wealth and then venture to invest in risky assets, other household characteristics are more decisive for the investment policy. Hence, analyses that aim to explain households' financial decision making would benefit from including the value of households' speculation-portfolio as wealth measure in combination with further household characteristic.[400]

[400] See Kaustia/Luotonen (2016) and Oehler (1995) for an overview of influential household characteristics. In particular, the finding that the FKP's gender and self-assessed risk attitude significantly influence the investment decisions is in line with previous literature, such as Croson/Gneezy (2009) (gender) and Dohmen et al. (2011) (risk attitude).

The analysis regarding the second aim was conducted along research questions RQ3 to RQ5.

> RQ3: Do households' total wealth or the value of their speculation-portfolio predict the efficiency of their speculation-portfolios for a buy-and-hold strategy?

Considering the value of the speculation-portfolio, households' total wealth has no significant influence on the efficiency of their speculation-portfolios for a buy-and-hold strategy. Neither has the value of the speculation-portfolio a direct influence on its efficiency. If any, the value of the speculation-portfolio acts through households' risk attitude; but with minor statistical and no economic significance. Hence, the results, at first glance, do not support findings of Vissing-Jorgensen (2004) and Calvet et al. (2007) and (2009a). Due to this thesis's focus on households' investment policy, households' abilities to pick individual stocks, bonds or other specific investment instruments are not analyzed. Hence, the discrepancy between the findings of Vissing-Jorgensen (2004) and Calvet et al. (2007) and (2009a) and this thesis's results may arise from differences in households' asset picking abilities or from higher fees payed by less wealthy households. Also, since this thesis does not analyze the efficiency of households' complete portfolio, it is still possible that there is a wealth effect regarding the efficiency of households' entire portfolio. However, being driven by the suggestion "to buy a broad-based index fund that bought and held all the [assets] in the market and that charged very low expenses"[401], this thesis contributes to the discussion whether employing a simple buy-and-hold strategy would be a helpful approach for all households and whether the implementation of such a strategy might reduce the (alleged) discrepancies between more and less wealthy households' investment success. If the sample of analyzed households had uniformly employed a buy-and-hold strategy in the same index funds, less wealthy households would not have suffered from less efficient portfolios even though they have a different investment policy than more wealthy households.

[401] Malkiel (2003), p. 4.

RQ4: Does portfolio rebalancing enhance the efficiency of households' speculation-portfolios?

Even in the absence of management fees and transaction costs, the analyzed households on average would have hardly benefited from portfolio rebalancing compared to a buy-and-hold-strategy in the period from September 2010 to July 2015. This finding is in line with French (2008), Dayanandan/Lam (2015), and von Gaudecker (2015) but contradicts the benefits of portfolio rebalancing suggested by Bouchey et al. (2012), Harjoto/Jones (2006), Jacobs et al. (2014), and Tsai (2001). The results of this thesis, yet, are subject to the limitation that the asset markets were almost throughout in a bullish phase in the observation period. These market conditions are, on principle, more favorable for a buy-and-hold strategy.[402] Nevertheless, since Bonaparte/Cooper (2009) and Brunnermeier/Nagel (2008) state that households hardly rebalance their portfolios, this thesis's findings at least indicate that households do not suffer from their inertia in bullish market phases.

RQ5: Does households' total wealth or the value of their speculation-portfolio influence the effect of portfolio rebalancing on the speculation-portfolios' efficiency?

Households' total wealth or the value of their speculation-portfolio has no clear influence on the effect of portfolio rebalancing on the speculation-portfolios' efficiency. Although a higher value of the speculation-portfolio occasionally has a positive statistically significant influence on the efficiency gains from rebalancing, the explanatory power of the underlying regression analyses is hardly sufficient and the economic effect is negligible.

[402] See Perold/Sharpe (1988).

9 Critical Appraisal and Implications

The discussion regarding the suitability of different data sources for empirical analyses in the field of household finance in Section 4.2 already showed that currently there is no dataset available without weaknesses. The data source of this thesis required certain assumptions which probably lead to deviations between the computed portfolio risk and return and the actual risk and return of households' portfolios. One of these assumptions was that every household, per asset class, solely invests in the ETF with the highest trading volume and a German/European index as underlying. Another assumption was that households generally do not transfer wealth to/from the speculation-portfolio and, therefore, reinvested all of the cash inflows generated by the speculation-portfolio (e.g. interest payments and dividends).[403] Furthermore, households' answers regarding the value invested in the different asset classes are expected to be imprecise, because they are most probably rounded and not reported in real-time (furthermore, an exact timestamp is missing).

However, these weaknesses of the data source are accepted in return for the detailed collection of household-specific characteristics captured in the survey. Besides, although the data reported by the households might differ from the actual data, the survey by and large should capture households' financial risk-taking and wealth in the way the households perceive them. Since the perceived wealth and risk-taking are more likely to be the drivers of households' investment decisions than the actual wealth and risk-taking[404], the survey data provides some interesting results that are inaccessible in account data.

Since the implementation of the Behavioral Portfolio Theory (BPT) provided in this thesis is designed for the German social system, further research with implementations of the BPT in other countries is required to support this thesis's results. The respective research could also include questionnaires to uncover the structure and constituents of households' mental accounts. Moreover, further research that combines the detailed information on household characteristics captured by surveys with more precise portfolio data, e.g. account or administrative

[403] This assumption, however, might be a minor issue since Brunnermeier/Nagel (2008) find that households rebalance their portfolio only very slowly after inflows and outflows or capital gains and losses. Nevertheless, studies that rely on panel data, such as Calvet et al. (2009a), Calvet/Sodini (2014), and Paya/Wang (2016), do not suffer from this issue.

[404] See Kahneman/Tversky (1979).

data, should yield valuable insights. Studies with such datasets could, e.g., elaborate whether the results solely derived from survey data can be supported with account data. In addition, such studies could shed light on the question whether households' perceived asset allocation significantly differs from their actual asset allocation and how this potential discrepancy impacts households' investment policy. Ideally, these studies should also rely on panel- instead of cross-sectional data.[405] Albeit, this thesis's empirical analyses show that extending normative portfolio choice models with behavioral insights could considerably increase the models' explanatory power. Researchers should, therefore, include the BPT in models on households' financial decision making and behavior in financial markets. Further research regarding these models could also tackle the question whether households explicitly are aware – and, if so, to which degree – that they rely on mental accounts when making investment decisions. Obviously, this strand of research may also derive refinements, e.g. conditional on households' family structure[406], regarding implementations of the BPT that even better explain households' actual portfolio choice than the implementation used in this thesis.[407]

Aside from impulses for further research, the results of this thesis also provide implications for policymakers and practitioners. The results suggest that households consider rather the value of their speculation-portfolio than their total wealth in the financial decision making process.[408] A possible explanation for this phenomenon is that the value of the speculation-portfolio is better accessible and assessable for households than their total wealth (e.g. through brokerage and online banking platforms). When proposing new initiatives, policymakers and regulators can probably make use of households' isolated consideration of their speculation-portfolio, e.g., households should be more likely to opt-in (or less likely to opt-out[409]) in governmental programs that immediately contribute to an increase of their speculation-portfolio's value than to an increase of their total wealth.

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[405] See Calvet/Sodini (2014).

[406] So far, there is hardly any research on how the family structure of a household influences its portfolio structure, i.e. the number and size of the mental accounts. It is, e.g., unclear whether households of blended families or families with two laboring generations assign all their assets to one hierarchical portfolio consisting of several mental accounts or whether some households assign their assets to more than one hierarchical portfolios with several mental accounts.

[407] See Oehler (2017b) and Oehler/Reisch (2012) regarding the necessity of further research in the fields of financial services and decision making with a focus on consumers such as households.

[408] However, the results do not allow the conclusion that households do not consider their total wealth in financial decisions at all.

[409] E.g. if households are already nudged in a governmental program (see Oehler (2015c)).

The empirical results, furthermore, suggest that households are able to create their speculation-portfolio in accordance to their self-reported risk attitude, although it remains unclear whether this is due to external assistance such as financial advisers. Nevertheless, policymakers and financial advisers should be aware of the significant influence of households' self-assessed risk attitude and provide governmental programs and financial advice with multiple options that differ in the required financial risk-taking to account for the households' different risk attitudes.[410]

The question why the efficiency of households' speculation-portfolio is not wealth dependent, neither for a buy-and-hold nor for rebalancing strategies, remains unanswered in this thesis. Still, the results suggest that less wealthy households do not systematically suffer from less efficient portfolios than more wealthy households.[411] In addition, no household would have benefitted from frequent rebalancing in the analyzed observation period. Hence, this thesis supports the implication of Harjoto/Jones (2006) and Tokat/Wikas (2007) that reasonable (e.g., yearly) monitoring frequencies (maybe in combination with the input of a financial adviser) are sufficient for households to control the (expected) risk and return and, as a consequence, the efficiency of their speculation-portfolio.

[410] Admittedly, it is hardly helpful to swamp households with too many options for choice. Instead policymakers and financial advisers have to strike a balance between providing a sufficient number of options and triggering choice overload (see Oehler (2013d)). This also applies to the provided information (see Brönneke/Oehler (2013), Oehler (2018)) and follows the approach to treat households in a differentiated way instead of lumping them together (see Oehler (2017b)).

[411] See also Bach et al. (2017) who do not find evidence that the richest percent of the Swedish households have exceptional investment skills.

References

Ackert, L. (2014), Traditional and Behavioral Finance; in: Baker, H. K., Ricciardi, V. (Eds.), Investor Behavior: The Psychology of Financial Planning and Investing, Wiley, Hoboken, 25-41

Adcock, C., Areal, N., Armada, M., Ceu Cortez, M., Oliveira, B., Silva, F. (2012), Conditions under Which Portfolio Performance Measures Are Monotonic Functions of the Sharpe Ratio, Working paper, University of Sheffield Management School, Sheffield

Admati, A., Bhattacharya, S., Pfleiderer, P., Ross, S. (1986), On Timing and Selectivity; in: *Journal of Finance* 41, Issue 3, 715-730

Agnew, J., Balduzzi, P., Sundén, A. (2003), Portfolio choice and trading in a large 401(k) plan; in: *American Economic Review* 93, 193-215

Alchian, A. (1965), Some Economics of Property Rights; in: *Il Politico* 30, Issue 4, 816-829

Alchian, A., Demsetz, H. (1972), Production, Information Costs, and Economic Organization; in*: American Economic Review* 62, Issue 5, 777-795

Alchian, A., Demsetz, H. (1973), The Property Right Paradigm; in: *Journal of Economic History* 33, Issue 1, 16-27

Alchian, A., Woodward, S. (1988), The firm is dead; long live the firm: A review of Oliver E. Williamson's The Economic Institutions of Capitalism; in: *Journal of Economic Literature* 26, Issue 1, 65-79

Alexander, G., Baptista, A., Yan, S. (2017), Portfolio selection with mental accounts and estimation risk; in: *Journal of Empirical Finance* 41, 161-186

Almadi, H., Rapach, D., Suri, A. (2014), Return Predictability and Dynamic Asset Allocation: How Often Should Investors Rebalance? in: *Journal of Portfolio Management* 40, Issue 4, 16-27

Akerlof, G. A. (1970), The market for "lemons": Quality uncertainty and the market mechanism; in: *The Quarterly Journal of Economics* 84, Issue 3, 488-500

Ameriks, J., Zeldes, S. (2004), How do household portfolio shares vary with age?, Working paper, Columbia University

Anderson, A. (2005), Is Online Trading Gambling with Peanuts?, Working Paper, Swedish Institute for Financial Research

Arrondel, L., Bartiloro, L., Fessler, P., Lindner, P., Mathä, T., Rampazzi, C., Savignac, F., Schmidt, T., Schürz, M., Vermeulen, P. (2016), How do households allocate their assets? - Stylized facts from the Eurosystem Household Finance and Consumption Survey; in: *International Journal of Central Banking* 12, 129-220

Arrow, K. (1964), The Role of Securities in the Optimal Allocation of Risk-Bearing; in: *Review of Economic Studies* 31, Issue 2, 91-96

Arrow, K. (1965), Aspects of the Theory of Risk-Bearing, Yrjö Jahnssonin Säätiö, Helsinki

Arrow, K. (1971), Essays in the Theory of Risk-Bearing, Amsterdam
Asness, C., Moskowitz, T., Pedersen, L. (2013), Value and Momentum Everywhere; in: *Journal of Finance* 68, Issue 3, 929-985

Aubram, T., Kovarova-Simecek, M., Wanzenried, G. (2016), Financial Literacy, Pension Planning, and Investment Behavior, Working Paper, UAS St. Pölten

Bach, L., Calvet, L., Sodini, P. (2017), Rich Pickings? Risk, Return, and Skill in the Portfolios of the Wealthy; Working Paper, available at SSRN: https://ssrn.com/abstract=2706207

Badarinza, C., Campbell, J., Ramadorai, T. (2016), International Comparative Household Finance; in: *Annual Review of Economics* 8, 111-144

Baddeley, M. (2013), Behavioural Economics and Finance, Routledge, New York

Baele, L., Inghelbrecht, K. (2009) Time-varying integration and international diversification strategies; in: *Journal of Empirical Finance* 16, 368-387

Bakshi, G. S., Chen, Z. (1994), Baby Boom, Population Aging, and Capital Markets; in: *Journal of Business* 67, Issue 2, 165-202

Balasubramnian, B., Brisker, E. (2016), Financial Advisor Users and Financial Literacy'; in: *Financial Services Review* 25, 127-155

Baltzer, M., Stolper, O., Walter, A. (2015), Home-field advantage or a matter of ambiguity aversion? Local bias among German individual investors; in: *European Journal of Finance* 21, 734-754

Bamberg, G., Coenenberg, A., Krapp, M. (2013), Betriebswirtschaftliche Entscheidungslehre, 15th ed., Verlag Franz Vahlen, München

Barber, B. M., Lee, Y.-T. Liu, Y.-J., Odean, T. (2009), Just How Much Do Individual Investors Lose by Trading? in: *Review of Financial Studies* 22, 609-632

Barber, B. M., Odean T. (2000), Trading Is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors; in: *Journal of Finance* 55, 773-806

Barber, B. M., Odean T. (2001), Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment, in: *The Quarterly Journal of Economics* 116, 261-292

Barber, B. M., Odean, T. (2013), The Behavior of Individual Investors; in: Constantinides, G. M., Harris, M., Stulz, R. M. (Eds.), Handbook of the Economics of Finance, Elsevier Science, Amsterdam, 1533-1570

Barberis, N., Huang, M., Thaler, R. (2006), Individual Preferences, Monetary Gambles and Stock Market Participation: A Case for Narrow Framing; in: *American Economic Review* 96, Issue 4, 1069-1090

Barberis, N., Thaler, R. (2003), A Survey of Behavioral Finance; in: Constantinides, G., Harris, M., Stulz, R. (Eds.), Handbook of the Economics of Finance, Elsevier Science, Amsterdam, 1053-1128

Barr, D. G., Priestley R. (2004), Expected Returns, Risk and the Integration of International Bond Markets; in: *Journal of International Money and Finance* 23, 71-97

Barras, L., Scaillet, O., Wermers, R. (2010), False discoveries in mutual fund performance: Measuring luck in estimated alpha; in: *Journal of Finance* 65, Issue 1, 179-216

Barsky, R., Juster, F. T., Kimball, M., Shapiro, M. D. (1997), Preference Parameters and Behavioral Heterogeneity: An Experimental Approach in the Health and Retirement Study; in: *The Quarterly Journal of Economics* 112, Issue 2, 537-579

Bauer, R., Cosemans, M., Eichholtz, P. (2007), The Performance and Persistence of Individual Investors: Rational Agents of Tulip Maniacs?, Discussion Paper 2007-034. Network for Studies on Pensions, Aging and Retirement

Bauhus, J. et al. (2012), Politikstrategie Food Labelling. Gemeinsame Stellungnahme der Wissenschaftlichen Beiräte für Verbraucher- und Ernährungspolitik sowie Agrarpolitik beim BMELV, Berichte über Landwirtschaft; in: *Zeitschrift für Agrarpolitik und Landwirtschaft* 90, Issue 1, 35-69

Beauchamp, J., Cesarini, D., Johannesson, M. (2017), The psychometric properties of measures of economic risk preferences; in: *Journal of Risk and Uncertainty* 54, Issue 3, 203-237

Bekaert, G., Harvey, C. R. (2000), Foreign speculators and emerging equity markets; in: *Journal of Finance* 55, Issue 29, 565-613

Bekaert, G., Hodrick, R. J., Zhang, X. (2009), International stock return comovements; in: *Journal of Finance* 64, Issue 6, 2591-2626

Bekaert, G., Hoyem, K., Hu W.-Y., Ravina, E. (2017), Who is internationally diversified? Evidence from the 401(k) plans of 296 firms; in: *Journal of Financial Economics* 124, Issue 1, 86-112

Benartzi, S., Thaler, R. (1995), Myopic Loss Aversion and the Equity Premium Puzzle; in: *The Quarterly Journal of Economics* 110, 73-91

Benhabib, J., Bisin, A. Zhu, S. (2011), The Distribution of Wealth and Fiscal Policy in Economies with Finitely Lived Agents, in: *Econometrica* 79, 122–57

Bernheim, B., Garrett, D., Maki, D. (2001), Education and Saving: The Long-term Effect of High School Financial Curriculum Mandates; in: *Journal of Public Economics* 80, 435-465

Bertraut, C. C. (1998), Stockholding Behavior of U.S. Households: Evidence from the 1983-1989 Survey of Consumer Finances; in: *The Review of Economics and Statistics* 80, Issue 2, 263-275

Bhattacharya, U., Loos, B., Meyer, S., Hackethal, A. (2017), Abusing ETFs; in: *Review of Finance* 21, Issue 3, 1217-1250

Bilias, Y., Georgarakos, D., Haliassos, M. (2010), Portfolio Inertia and Stock Market Fluctuations; in: *Journal of Money, Credit and Banking* 42, Issue 4, 715-742

Bitz; M. (1984), On the discussion regarding the theoretical implications of preferences of the Bernoulli Principle [Zur Diskussion um die präferenztheoretischen Implikationen des Bernoulli-Prinzips]; in: *Zeitschrift für Betriebswirtschaft 54*, Issue 11, 1077 – 1089

Bitz, M. (1993), Foundations of Financial Risk Management [Grundlagen des finanzwirtschaftlich orientierten Risikomanagements]; in: Gebhardt, G., Gerke, W., Steiner, M. (Eds.), Handbuch des Finanzmanagements - Instrumente und Märkte der Unternehmensfinanzierung, Beck, München, 641-668

Bitz, M., Stark, G. (2008), Financial Services [Finanzdienstleistungen], 8th ed., Oldenbourg Verlag, München a.o.

Bloomfield, R. (2010), Traditional Versus Behavioral Finance; in: Baker, K., Nofsinger, J. (Eds.), Behavioral Finance, 23-38

Boldin, M., Cici, G. (2010), The index fund rationality paradox; *in: Journal of Banking and Finance* 34, Issue 1, 33-34

Bollen, N., Posavac, S. (2018), Gender, risk tolerance, and false consensus in asset allocation recommendations, in: *Journal of Banking and Finance* 87, February 2018, 304-317

Bonaparte, Y., Cooper, R. (2009), Costly Portfolio Adjustment, NBER Working Paper 15227

Bonaparte, Y., Korniotis, G., Kumar, A. (2014), Income Hedging and Portfolio Decisions; in: *Journal of Financial Economics* 113, Issue 2, 300-324

Booth, A. L. and Katic, P. (2013), Cognitive Skills, Gender and Risk Preferences, in: *Economic Record* 89, Issue 284, 19-30

Bouchey, P., Nemtchinov, V., Paulsen, A., Stein, D. (2012), Volatility Harvesting: Why Does Diversifying and Rebalancing Create Portfolio Growth?; in: *Journal of Wealth Management*, 26-35

Braunstein, S., Welch, C. (2002), Financial Literacy: An Overview of Practice, Research, and Policy; in: *Federal Reserve Bulletin*, 445-457

Brennan, M. J., Henry H. C. (1997), International Portfolio Investment Flows; *in: Journal of Finance* 52, Issue 5, 1851-1880

Brinson, G., Hood, R., Beebower, G. (1986), Determinants of Portfolio Performance; in*: Financial Analysts Journal* 42, Issue 4, 39-44

Brinson, G., Hood, R., Beebower, G. (1995), Determinants of Portfolio Performance; in: *Financial Analysts Journal* 51, Issue 1, 133-138

Brinson, G., Singer, B., Beebower, G. (1991), Determinants of Portfolio Performance II: An Update; *in: Financial Analysts Journal* 47, Issue 3, 40-48

Brönneke, T. Oehler, A. (2013), Which legal Instruments does Consumer Policy need? [Welche rechtlichen Instrumente braucht die Verbraucherpolitik?], Stellungnahme des Wissenschaftlichen Beirats Verbraucher- und Ernährungspolitik beim BMELV, Berlin

Brown, S. J.,Goetzmann, W. N. (1995), Performance Persistence*; in: Journal of Finance* 50, Issue 2, 679-698

Brunnermeier, M. K., Nagel, S. (2008), Do Wealth Fluctuations Generate Time-Varying Risk Aversion? Micro-Evidence on Individuals' Asset Allocation; *in: American Economic Review* 98, Issue 3, 713-736

Busse, J.A., Goyal, A., Wahal, S. (2010), Performance and Persistence in Institutional Invesment Management; in: *Journal of Finance* 65, Issue 2, 765-790

Calvet, L., Campbell, J., Sodini, P. (2007), Down or Out: Assessing the Welfare Costs of Household Investment Mistakes; in: *Journal of Political Economy* 115, 707-747

Calvet, L., Campbell, J., Sodini, P. (2009a), Fight or Flight? Portfolio Rebalancing by Individual Investors; in: *The Quarterly Journal of Economics* 124, 301-348

Calvet, L., Campbell, J., Sodini, P. (2009b), Measuring the Financial Sophistication of Households; in: *American Economic Review* 99, 393-398

Calvet, L. E., Sodini, P. (2014), Twin Picks: Disentangling the Determinants of Risk-Taking in Household Portfolios; in: *Journal of Finance* 69, Issue 2, 867-906

Campbell, J. (2003), Consumption-based asset pricing; in: George, C., Milton, H., Rene, S. (Eds.), Handbook of the economics of finance, Vol. IB, Elsevier Science, Amsterdam, 803-887

Campbell, J. (2006), Household Finance; in: *Journal of Finance* 61, Issue 4, 1553-1604

Campbell, J. (2016), Restoring Rational Choice: The Challenge of Consumer Financial Regulation. NBER Working Paper No. 22025

Campbell, J., Ramadorai, T., Ranish, B. (2014), Getting Better or Feeling Better? How Equity Investors Respond to Investment Experience. NBER Working Paper No. 20000

Carhart, M. M. (1997), On the Persistence of Mutual Fund Performance; in: *Journal of Finance* 52, Issue 1, 57-82

Carhart, M. M., Carpenter J. N., Lynch, A. W., Mustro, D. K. (2002), Mutual Fund Survivorship; in: *Review of Financial Studies* 15, 5, 1439-1463

Cezanne, W., Mayer, A. (1998), New Institutional Economics – A Review [Neue Institutionenökonomik - Ein Überblick]; in: *Wirtschaftsstudium* 27, Issue 11, 1345-1353

Chan, K., Covrig V., Ng, L. (2005), What Determines the Domestic Bias and Foreign Bias? Evidence from Mutual Fund Equity Allocations World-Wide; in: *Journal of Finance* 60, Issue 3, 1495-1534

Chatterjee, S., Fan, L., Jacobs, B., Haas, R. (2017), Risk Tolerance and Goals-Based Savings Behavior of Households: The Role of Financial Literacy; in: *Journal of Personal Finance* 16, Issue 1, 66-77

Chen, W.-P., Chung, H., Ho, K.-Y., Hsu, T.-L. (2010), Theoretical Framework of Finance, in: Lee, C.-F., Lee, A., Lee, J. (Eds.), Handbook of Quantitative Finance and Risk Management, Springer, New York, 3-22

Chen, Z., Epstein, L. (2002), Ambiguity, risk and asset returns in continuous time; in: *Econometrica* 70, 1403 - 1443

Chiappori, P.-A., Paiella, M. (2011), Relative Risk Aversion Is Constant: Evidence From Panel Data; in: *Journal of the European Economic Association* 9, Issue 6, 1021-1052

Christelis, D., Jappelli, T., Padula, M. (2010), Cognitive abilities and portfolio choice, in: *European Economic Review* 54, Issue 1, 18-38

Christoffersen, P., Errunza V., Jacobs, K., Langlois, H. (2012), Is the Potential for International Diversification Disappearing? A Dynamic Copula Approach; in: *The Review of Financial Studies* 25, Issue 12, 3711-3751

Choi, J, Laibson, D, Madrian, B. C. (2011), $100 bills on the sidewalk: suboptimal investment in 401(k) plans; in: *Review of Economics and Statistics* 93, Issue 3, 748-763

Choi, J. J., Laibson, D., Metrick, A. (2002), How does the internet affect trading? Evidence from investor behavior in 401(k) plans; in: *Journal of Financial Economics* 64, 397-421

Coase, R. H. (1937), The Nature of the Firm; in: *Econometrica* 16, Issue 4, 386-405

Coase, R. H. (1988), The Firm, the Market, and the Law, Chicago

Coase, R. H. (2005), The Institutional Structure of Production; in Menard, C., Shirley, M. (Eds.) Handbook of New Institutional Economics, Springer, Dordrecht, 31-39.

Cocco, J. (2005), Portfolio choice in the presence of housing; in: *The Review of Financial Studies* 18, Issue 2, 535-567

Coen, A. (2001), Home Bias and International Capital Asset Pricing Model with Human Capital; in: *Journal of Multinational Financial Management* 11, Issue 4-5, 497-513

Cohn, R. A., Lewellen, W. G., Lease, R. C., Schlarbaum, G. G. (1975), Individual Investor Risk Aversion and Investment Portfolio Composition; in: *Journal of Finance* 30, Issue 2, 605-620

Cole, S., Paulson, A., Shastry, G. (2014), Smart Money? The Effect of Education on Financial Outcomes; in: *Review of Financial Studies* 27, Issue 7, 2022-2051

Cooper, I., Sercu, P., Vanpee, R. (2012), The Equity Home Bias Puzzle: A Survey; in: *Foundations and Trends in Finance* 7, Issue 4 289-416

Cooper, I., Kaplanis, E. (1994), The Implications of the Home Bias in Equity Portfolios; in: *Business Strategy Review* 5, Issue 2, 41-53

Croson, R., Gneezy, U. (2009), Gender differences in preferences; in: *Journal of Economic Literature* 47, Issue 2, 448-474

Cremers, M., Petajisto, A. (2009), How Active Is Your Fund Manager? A New Measure That Predicts Performance; in: *Review of Financial Studies* 22, Issue 9, 3329-3365

Curcuru, S., Heaton, J., Lucas, D. and Moore, D. (2010), Heterogeneity and portfolio choice: theory and evidence; in Ait-Sahalia, Y., Hansen, L. P. (Eds.), Handbook of Financial Econometrics I, Elsevier Science, Amsterdam, 337-382

Dahlquist, M., Pinkowitz, L., Stulz, R. M., Williamson, R. (2003), Corporate Governance and the Home Bias; in: *Journal of Financial and Quantitative Analysis* 38, Issue1, 87-110

Daniel, K., Grinblatt, M., Titman, S., Wermers, R. (1997), Measuring mutual fund performance with characteristic-based benchmarks; in: *Journal of Finance* 52, 1035-1058

Daryanani, G (2008), Opportunistic Rebalancing: A New Paradigm for Wealth Managers; in: *Journal of Financial Planning* 21, Issue 1, 48-61.

Das, S., Markowitz, H., Scheid, J., Statman, M. (2010), Portfolio Optimization with Mental Accounts; in: *Journal of Financial and Quantitative Analysis* 45, Issue 2, 311-334

Dayanandan, A., Lam, M. (2015), Portfolio Rebalancing – Hype or Hope?; in: *Journal of Business Inquiry* 15, Issue 2, 79-92.

De Bondt, W., Muradoglu, G., Shefrin, H., Staikouras, S. K. (2008), Behavioral finance: Quo vadis; in: *Journal of Applied Finance* 18, Issue 2, 7-21

De Bondt, W., Thaler, R. (1985), Does the stock market overreact; in: *Journal of Finance* 40, 793 – 805

Debreu, G. (1959), Theory of Value, Wiley, New York

Deepak, C., Singh, P., Kumar, A. (2015), Financial Literacy among Investors: Theory and Critical Review of Literature; in: *International Journal of Research in Commerce, Economics, and Management* 5, 99-103

Demsetz, H. (1967), Toward a Theory of Property Rights; in: *American Economic Review* 57, Issue 2, 347-359

Deuflhard, F., Georgarakos, D., Inderst, R. (2015), Financial Literacy and Saving Account Returns, Working Paper, Frankfurt

Deutsche Bundesbank (2015), German households' saving and investment behaviour in light of the low-interest-rate environment, Deutsche Bundesbank Monatsbericht, Oktober 2015, 13-31

Deutsche Bundesbank (2016), Household wealth and finances in Germany: results of the 2014 survey [Vermögen und Finanzen privater Haushalte in Deutschland: Ergebnisse der Vermögensbefragung 2014]. Deutsche Bundesbank Monatsbericht, März 2016, 61-86

Dhar, R., Zhu, N. (2006), Up Close and Personal: Investor Sophistication and the Disposition Effect; in: *Management Science* 52, 726-740

Dichtl, H., Drobetz, W., Wambach, M. (2016), Testing Rebalancing Strategies for Stock-Bond Portfolios Across Different Asset Allocations. Applied Economics, 48(9), 772-788.

Dimmock, S., Kouwenberg, R. (2010), Loss-aversion and Household Portfolio Choice; in: *Journal of Empirical Finance* 17, 441-459

Dixon, M. (2006), Rethinking Financial Capability. Lessons from Economic Psychology and Behavioural Finance, Institute for Public Pension Policy Research, York a.o.

Dohmen, T., Falk, A., Huffman, D., Sunde, U. (2010), Are risk aversion and impatience related to cognitive ability?; in: *American Economic Review* 100, Issue 3, 1238-1260

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., Wagner, G. G., (2011), Individual Risk Attitudes: Measurement, Determinants and Behavioral Consequences; in: *Journal of the European Economic Association* 9, Issue 3, 522-550

Dohmen, T., Falk, A., Golsteyn, B., Huffman, D., Sunde, U. (2017), Risk Attitudes Across The Life Course; in: *Economic Journal* 127, Issue 605, 95-116

Dorn, D., Huberman, G. (2005), Talk and Action: What Individual Investors Say and What They Do; in: *Review of Finance* 9, Issue 4, 437-481

Dwyer, P., Gilkeson, J. H., List, J. A. (2002), Gender differences in revealed risk taking: evidence for mutual fund investors; in: *Economics Letters* 76, 151-158

Easley, D., O'Hara, M. (2003), Microstructure and Asset Pricing; in: Constantinides, G. M., Harris, M., Stulz, R. M. (Eds.), Handbook of the Economics of Finance 1, Part B, 1021-1051

Eckel, C. C., Grossman, P. J. (2008), Men, women and risk aversion: experimental evidence; in: Plott, C. R., Smith, V. L. (Eds.), Handbook of Results in Experimental Economics, North Holland/Elsevier Press

Eling, M. (2008), Does the Measure Matter in the Mutual Fund Industry?; in: *Financial Analyst Journal* 64, Issue 3, 54-66

Eiling, E., Gerard B., (2015), Emerging Equity Market Comovements: Trends and Macro-Economic Fundamentals; in: *Review of Finance* 19, Issue 4, 1543-1585

Eisenführ, F, Weber, M. (1999), Rational Decision Making [Rationales Entscheiden], 3. Auflage, Springer, Berlin

Elton, E., Gruber, M. (2013), Mutual Funds; in: Constantinides, G. M., Harris, M., Stulz, R. M. (Eds.), Handbook of the Economics of Finance, Elsevier Science, Amsterdam, 1011-1061

Elton, E. J., Gruber, M. J., Blake, C. R. (1996), Survivorship Bias and Mutual Fund Performance; in: *Review of Financial Studies* 9, Issue 4, 1097-1120

Epstein, L. (1999), A Definition of Uncertainty Aversion; in: *The Review of Economic Studies* 66, Issue 3, 579-608

Errunza, V. R. (1977), Gains from portfolio diversification into less developed countries' securities; in: *Journal of International Business Studies* 55, 83-99

Errunza, V. R., Hogan Jr., K., Hung, M.-W. (1999), Can the gains from international diversification be achieved without trading abroad?; in: *Journal of Finance* 54, Issue 6, 2075-2107

Fabozzi, F., Markowitz, H., Kolm, P., Gupta, F. (2011), Portfolio Selection; in: Fabozzi, F., Markowitz, H., (Eds.), The theory and practice of investment

management: asset allocation, valuation, portfolio construction, and strategies, Wiley, Hoboken, 45-77

Fagereng, A., Gottlieb, C., Guiso, L. (2017), Asset Market Participation and Portfolio Choice over the Life-Cycle; in: *Journal of Finance* 72, Issue 2, 705-750

Fama, E. F. (1970), Efficient capital markets: A review of theory and empirical work; in: *Journal of Finance* 25, Issue 2, 383-417

Fama, E. F. (1991), Efficient capital markets: II; in: *Journal of Finance,* 46, Issue 5, 1575-1617

Fama, E. (1998), Market efficiency, long-term returns, and behavioral finance; in: *Journal of Financial Economics* 49, 283-306

Fama, E. (2014), Two Pillars of Asset Pricing; in: *American Economic Review* 104, Issue 6, 1467-1485

Fama, E., K. French (1992), The Cross-Section of Expected Stock Returns; in: *Journal of Finance* 67, Issue 2, 427-465

Fama, E., K. French (1993), Common risk factors in the returns on stocks and bonds; in: *Journal of Financial Economics* 33, Issue 1, 3-56

Fama, E., French, K. (2004), The Capital Asset Pricing Model: Theory and Evidence; in: *Journal of Economic Perspectives* 18, Issue 3, 25-46

Fama, E., French, K. (2010), Luck versus Skill in the Cross-Section of Mutual Fund Returns; in: *Journal of Finance* 65, Issue 5, 1915-1947

Fama, E., K. French (2015), A five-factor asset pricing model; in: *Journal of Financial Economics* 116, Issue 1, 1-22

Fama, E., Jensen, M. (1983), Separation of Ownership and Control; in: *Journal of Law & Economics* 26, Issue 2, 301-325

Foerster, S., Linnainmaa, J., Melzer, B., Previtero, A. (2017) Retail Financial Advice: Does One Size Fit All; in: *Journal of Finance* 72, Issue 4, 1441-1482

Franke, G., Hax, H. (2009), Corporate Finance and Capital Market [Finanzwirtschaft des Unternehmens und Kapitalmarkt]. 6th ed., Springer, Berlin a.o.

French, K. (2008), Presidential Address: The Cost of Active Investing; in: *Journal of Finance* 63, 1537-1573

French, K., Poterba, J. (1991), Investor diversification and international equity markets; in: *American Economic Review* 81, Issue 2, 222-226

Friend, I., Blume, M. E. (1975), The demand for risky assets; in: *American Economic Review 65*, Issue 5, 900-922

Gehring, T. (1993), An information Based Explanation of the Domestic Bias in International Equity Investment; in: *Scandinavian Journal of Economics* 95, Issue 1, 97-109

Georgarakos, D. (2014), Diversification and Asset Allocation Puzzles; in: Baker, H. K., Ricciardi, V. (Eds.), Investor Behavior: The Psychology of Financial Planning and Investing, Wiley, Hoboken, 403-420,

Giannetti, M., Koskinen, Y. (2003), Investor Protection and Equity Holdings: An Explanation of Two Puzzles?, Working Paper, Stockholm School of Economics/ The Economic Research Institute

Goetzmann, W., Kumar, A. (2008), Equity Portfolio Diversification; in: *Review of Finance* 12, Issue 3, 433-463

Goetzmann, W.N., Ibbotson, R.G. (1994), Do winners repeat? Patterns in mutual fund performance; in: *Journal of Portfolio Management* 20, Issue 2, 9-17

Goodman, L., (1960), On the Exact Variance of Products; in: *Journal of the American Statistical Association* 55, Issue 292, 708-713

Gorton, G., Winton, A. (2003), Financial Intermediation. in: George M. Constantinides, Harris, M., Stulz, R. M. (Eds.), Handbook of the Economics of Finance 1, Part A, 432-552

Graham, J. R., Harvey, C. R., Huang, H. (2009), Investor Competence, Trading Frequency, and Home Bias, in: *Management Science* 55, Issue 7, 1094-1106

Greenbaum, S., Thakor, A. (2007), Contemporary Financial Intermediation, 2nd ed., Elsevier, Burlington

Grinblatt, M., Keloharju, M. (2000), The Investment Behavior and Performance of Various Investor Types: A Study of Finland's Unique Data Set; in: *Journal of Financial Economics* 55, 43-67

Grinblatt, M., Keloharju, M. (2009), Sensation Seeking, Overconfidence, and Trading Activity; in: *Journal of Finance* 64, 549-578

Grinblatt, M., Keloharju, M., Linnainmaa, J. (2011), IQ and stock market participation; in: *Journal of Finance* 66, Issue 6, 2121-2164

Grinblatt, M., Keloharju, M., Linnainmaa, J. (2012); IQ, trading behavior, and performance; in: *Journal of Financial Economics* 104, Issue 2, 339-362

Grinblatt, M., Titman, S. (1992), The Persistence of Mutual Fund Performance; in: *Journal of Finance 47*, Issue 5, 1977-1984

Groves, R. (2004), Survey Errors and Survey Costs, Wiley, Hoboken

Grubel, H. G. (1968), Internationally Diversified Portfolios: Welfare Gains and Capital Flows; in: *American Economic Review* 58, Issue 5, 1299-1314

Guiso, L., Paiella, M. (2008), Risk aversion, wealth and background risk; in: *Journal of the European Economic Association* 6, Issue 6, 1109-1150

Guiso, L., Sodini, P. (2013), Household Finance: An Emerging Field, in Constantinides, G. M., Harris, M., Stulz, R. M. (Eds.), Handbook of the Economics of Finance, Elsevier Science, Amsterdam, 1397-1532

Guse, F., Rudolf, M. (2008), Skewness in Portfolio Selection [Schiefe in der Portfolioselektion], in: *Credit and Capital Markets* 41, Issue 2, 197-216

Hackethal, A., Haliassos, M., Jappelli, T. (2012), Financial advisors: A case of babysitters; in: *Journal of Banking & Finance* 36, 509-524

Hagen, K., Micklitz, H.-W., Oehler, A., Reisch, L, Strünck, C. (2013), Check Verbraucherpolitik und Verbraucherbeteiligung - Empfehlungen für eine evidenzbasierte Verbraucherpolitik, *Journal für Verbraucherschutz und Lebensmittelsicherheit* 8, 61-66

Haliassos, M., Bertaut, C. (1995), Why do so few hold stocks?; in: *The Economic Journal* 105, 1110-1129

Halko, M.-L., Kaustia, M., Alanko, E. (2012), The gender effect in risky asset holdings; in: *Journal of Economic Behavior and Organization* 83, 66-81

Harjoto, M., Jones, F. (2006), Rebalancing Strategy for Stocks and Bonds Asset Allocation; in: *Journal of Wealth Management* 9, Issue 1, 37-44

Harrison, G. W., Johnson, E., McInnes, M. M., Rutström, E. E. (2005), Temporal stability of estimates of risk aversion; in: *Applied Financial Economics Letters* 1, Issue 1, 31-35

Hartmann-Wendels, T., Pfingsten, A., Weber, M. (2007), Banking [Banketriebslehre], 4th ed., Springer, Berlin/Heidelberg,

Hartog, J., Ferrer-i-Carbonell, A., Jonker, N. (2002), Linking measured risk aversion to individual characteristics; in: *Kyklos* 55, Issue 1, 3-26

Hastings, J., Madrian, B., Skimmyhorn, W. (2013), Financial Literacy, Financial Education and Economic Outcomes; in: *Annual Review of Economics* 5, 347-373

Hirshleifer, D. (2015), Behavioral Finance; in: *Annual Review of Financial Economics* 7, 133-159

Heilmann, K., Läger, V., Oehler, A. (2000), Information Aggregation, Insider Trading, and Liquidity in Experimental Call Markets [Informationsaggregation, Insiderhandel, und Liquidität in experimentellen Call Markets]; in: *Zeitschrift für Bankrecht und Bankwirtschaft* 12, Issue 6, 361-371

Heilmann, K., Läger, V., Oehler, A. (2001), The Disposition Effect - Evidence on the Investors' Aversion to Realize Losses; in Fleischmann, B., Lasch, R., Derigs, U.,

Domschke, W., Rieder, U. (Eds.) Operations Research Proceedings 2000: Selected Papers of the Symposium on Operations Research (OR2000), Spriner, Berlin, 174-179

Hendricks, D., Patel, J., Zeckhauser, R. (1993), Hot hands in mutual funds: The persistence of performance, 1974-1988; in: *Journal of Finance* 48 Issue 1, 93-130

Herberger, T, Kohlert, D., Oehler, A. (2011), Momentum and industry-dependence: An analysis of the Swiss stock market; in: *Journal of Asset Management* 11, Issue 6, 391-400

Herberger, T., Horn, M., Oehler, A., (2015), Are Momentum Strategies Feasible in Intraday-Trading? Empirical Results from the German Stock Market; Conference Paper at International Conference on Operations Research, Hamburg, August 30 - September 2, 2016; 2016 Behavioural Finance Working Group Conference, London, June 13-14, 2016; 52nd Meeting of the Eastern Finance Association (EFA), Baltimore, April 6-9, 2016. 2015 Annual Meeting of the Financial Management Association International, October 14-17, Orlando/FL; 29th Annual Meeting The Academy of Financial Services 2015, October 15-16, Orlando/FL

Herberger, T., Horn, M., Oehler, A. (2018), Trading Strategies in Intraday-Trading: Do Momentum and Reversal in Stock Prices Exist?; 54th Meeting of the Eastern Finance Association (EFA), Philadelphia, April 11-14, 2018

Herberger, T, Oehler, A. (2011), IPOs as Exit Strategy for Financial Investors in the German IPO Market [IPOs als Exit-Strategie von Finanzinvestoren im deutschen IPO-Markt], in: *Corporate Finance* biz 2011, Issue 1, 52-61

Hilliard, J., Hilliard, J. (2018), Rebalancing versus buy and hold: theory, simulation and empirical analysis; in: *Review of Quantitative Finance and Accounting* 50, Issue 1, 1-32

Höfer, A., Oehler, A. (2013), Sell-Side Security Analysts in the Nexus of Principal Agent Relations: An Information Economics Perspective; in: *Corporate Ownership & Control* 10, 267-274

Hoffmann, A., Shefrin, H., Pennings, J. (2010), Behavioral Portfolio Analysis of Individual Investors. Working Paper available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1629786

Hood, R. (2005), Determinants of Portfolio Performance - 20 Years Later; in: *Financial Analysts Journal* 62, Issue 1, 6-8

Horn, M. (2018), Would Households Benefit from a Service that Rebalances their Risky Investments and Cash?, Working Paper, Bamberg University

Hummel, D. (1999), Neoinstitutionalism in Finance and Banking Theory – Aspects for Development and Applications of New Institutional Economics [Neoinstitutionalismus in der Finanzierungs- und Bankentheorie - Entwicklungsaspekte und Anwendungsfelder der New Institutional Economics], in: Edeling et al. (Eds.),

Institutionenökonomie und Neuer Institutionalismus: Überlegungen zur Organisationstheorie, 205-220

Ibbotson, R., Kaplan, P. (2000), Does Asset Allocation Policy Explain 40, 90, or 100 Percent of Performance?; in: *Financial Analysts Journal* 56, Issue 1, 26-33

Ilmanen, A. (1995), Time-varying expected returns in international bond markets; in: *Journal of Finance* 50, 481-506

Jacobs, H., Müller, S., Weber, M. (2014), How should individual investors diversify? An empirical evaluation of alternative asset allocation policies; in: *Journal of Financial Markets* 19, 62-85

Jegadeesh, N., Titman, S. (1993), Returns to buying winners and selling losers: implications for stock market efficiency; in: *Journal of Finance* 48, 65-91.

Jensen, M.C. (1968), The Performance of Mutual Funds in the Period 1945-1964; in: *Journal of Finance* 23, Issue 2, 389-416

Jensen, M. C. (1972), Capital Markets: Theory and Evidence, *The Bell Journal of Economics and Management Science* 3, Issue 2, 357-398

Jensen, M. C., Meckling, W. H. (1976), Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure; in: *Journal of Financial Economics* 3, Issue 4, 305-360

Jeske, K. (2001), Equity Home Bias: Can Information Cost Explain the Puzzle?; in: *Economic Review* 86, Issue 3, 31-42

Josef, A. K., Richter, D., Samanez-Larkin, G. R., Wagner, G. G., Hertwig, R., Mata, R. (2016), Stability and change in risk-taking propensity across the adult life span; in: *Journal of Personality and Social Psychology* 111, Issue 3, 430-450

Kacperczyk, M., Nieuwerburgh, S. V., Veldkamp, L., (2014), Time-varying fund manager skill; in: *Journal of Finance* 69, 1455-1484

Kahneman, D., Tversky, A. (1979), Prospect theory: An analysis of decision under risk; in: *Econometrica* 47, 263-291

Kaustia, M., Luotonen, N. (2016), What drives the heterogeneity in portfolio choice? The role of institutional, traditional, and behavioral factors, Conference paper at 2nd Research in Behavioral Conference 2016, Amsterdam

Keller, W., Butler, A., Kipnis, I. (2015). Momentum and Markowitz: A Golden Combination. Working Paper, available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2606884.

Kirchgässner, G. (2008), Homo Oeconomicus - The Economic Model of Behaviour and Its Applications in Economics and Other Social Sciences, Springer, New York

Knox, Thomas A. (2003), Foundations for learning how to invest when returns are uncertain, Working paper, University of Chicago Graduate School of Business

Korniotis, G., Kumar, A. (2011), Do older Investors Make Better Investment Decisions? in: *Review of Economics and Statistics* 93, Issue 1, 244-265

Lamedica, N., Reno, R. (2007), Integration of International Bond Markets: Did Anything Change with EMU? in: *Applied Economic Letters* 14, 829-832

Laurinaityte, N. (2018), Household Financial Risk Tolerance in Europe, Working Paper, Research Center SAFE and Goethe University Frankfurt, available at: https://ssrn.com/abstract=3175881

Le Blanc, Julia (n.y.), Editing the Panel on Household Finances (PHF)

Lee, C.-F., Lee, A., Lee, J. (2010) Foundation of Portfolio Theory. in: Lee, C.-F., Lee, A., Lee, J. (Eds.), Handbook of Quantitative Finance and Risk Management, Springer, 53-68

Lehmann, B. N., Modest, D. M. (1987), Mutual fund performance evaluation: A comparison of benchmarks and benchmark comparisons; in: *Journal of Finance* 42, Issue 2, 233-265

Levin, L. (1998), Are Assets Fungible? Testing the Behavioral Theory of Life-cycle Savings; in: *Journal of Economic Behavior and Organization* 36, 59-83

Levy, H., De Giorgi, E., Hens, T. (2012), Two paradigms and nobel prizes in economics: A contradiction or coexistence? in: *European Financial Management* 18, Issue 2, 163-182

Levy, H., Markowitz, H. (1979), Approximating Expected Utility by a Function of Mean and Variance; in: *American Economic Review* 69, Issue 3, 308-317

Levy, H., Sarnat, M. (1970), International Diversification of Investment Portfolios; in: *American Economic Review* 60, Issue 4, 668-675

Lewis, K. K. (1999) Trying to Explain Home Bias in Equities and Consumption; in: *Journal of Economic Literature* 37, Issue 2: 571-608

Linnainmaa, J. T. (2010), Do limit orders alter inferences about investor performance and behavior?; in: *Journal of Finance* 65, 1473-1506

Lintner, J. (1965), The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets; in: *The Review of Economics and Statistics,* 47, Issue 1, 13-37

Lopes, L. (1987), Between Hope and Fear: The Psychology of Risk; in: *Advances in Experimental Social Psychology* 20, 255-295

Lusardi, A. (2015), Financial Literacy: Do People Know the ABCs of Finance?; in: *Public Understanding of Science* 24, 260-271

Lusardi, A., Mitchell, O., (2006), Financial literacy and planning: implications for retirement wellbeing. NBER Working Paper No. 17078

Lusardi, A, Tufano, P. (2015), Debt literacy, financial experiences, and overindebtedness; in: *Journal of Pension Economics & Finance* 14, Issue 4, 332-368

Malkiel, B. (1995), Returns from Investing in Equity Mutual Funds 1971 to 1991; in: *Journal of Finance* 50, Issue 2, 549-572

Malkiel, B. (2003), The Efficient Market Hypothesis and Its Critics, Journal of Economic Perspectives 17, Issue 1, 59–82

Malkiel, B. (2013), Asset Management Fees and the Growth of Finance, *Journal of Economic Perspectives* 27, Issue 2, 97–108

Mankiw, N., Zeldes, S. (1991), The consumption of stockholders and non-stockholders; in: *Journal of Financial Economics* 29, 97-112

Marinelli, N., Mazzoli, C., Palmucci, F. (2017), Mind the Gap: Inconsistencies Between Subjective and Objective Financial Risk Tolerance; in: *Journal of Behavioral Finance* 18, Issue 2, 219-230

Markowitz, H. (1952), Portfolio Selection; in: *Journal of Finance* 7, Issue 1, 77-91

Markowitz, H. (1959), Portfolio Selection: Efficient Diversification of Investments, Yale University Press, New Haven a.o.

Markowitz, H. (1991), Foundations of Portfolio Theory; in: *Journal of Finance* 46, Issue 2, 469-477

Markowitz, H. (1999), The Early History of Portfolio Theory: 1600-1960; in: *Financial Analysts Journal* 55, Issue 4, 5-16

Mehra, R., Prescott, E. (1985), The Equity Premium - A Puzzle; in: *Journal of Monetary Economics* 15, 145-161

Merton, R. C. (1969), Lifetime portfolio selection under uncertainty: The continuous-time case; in: *Review of Economics and Statistics* 51, Issue 3, 247-257

Merton, R. (1971), Optimum consumption and portfolio rules in a continuous-time model; in: *Journal of Economic Theory* 3, 373-413

Merton, R. (1982), On the Microeconomic Theory of Investment under Uncertainty; in: Arrow, K., Intriligator, M. (Eds.), Handbook of Mathematical Economics, Vol. 2, North-Holland Publishing Company, Amsterdam, 601-669

Merton, R. (1992), Continuous-time finance, Blackwell, Cambridge, a.o.

Meyer, B. D., Mok, W. K. C., Sullivan, J. X. (2015), Household Surveys in Crisis; in: *Journal of Economic Perspectives* 29, Issue 4, 199-226

Meyll, T., Pauls, T., Walter, A. (2018), The household savings paradox; Conference paper at SGF 2018, the 80th Annual Meeting of the German Academic Association for Business Research (VHB), the 2018 Eastern Finance Association Annual Meeting, and the 2018 Annual Meeting of the European Financial Management Association.

Micklitz, H.-W., Oehler, A. (2006), Consumer Policy in the Digital World, Scientific Advisory Board for Consumer, Food, and Nutrition Policies to the Federal Ministry of Consumer Protection, Food, and Agriculture, Germany, Berlin

Miller, M., Modigliani, F. (1961), Dividend Policy, Growth, and the Valuation of Shares; in: *The Journal of Business* 34, Issue 4, 411-433

Mitchell, O., Mottola, G. R., Utkus, S. P., Yamaguchi, T. (2006), The inattentive participant: portfolio Trading behavior in 401(k) plans, working paper, University of Michigan Retirement Research Center

Morin, R. A., Suarez, A. F. (1983), Risk aversion revisited; in: *Journal of Finance* 38 Issue 4, 1201-1216

Mossin, J. (1966), Equilibrium in a capital market; in: *Econometrica* 34, Issue 4, 768-783

Nicolosi, G., Peng, L., Zhu, N. (2009), Do Individual Investors Learn from Their Trading Experience; in: *Journal of Financial Markets* 12, Issue 2, 317-336

Nosic, A., Weber, M. (2010), How risky do I invest: The role of risk attitudes, risk perceptions and overconfidence; in: *Decision Analysis* 7, Issue 3, 282-301

O'Hara, M. (1995), Market Microstructure Theory. Blackwell Publishers, Cambridge

Odean, T. (1998), Volume, Volatility, Price, and Profit When All Traders Are Above Average; in: Journal of Finance 53, Issue 6, 1887-1934.

Oehler, A. (1991), „Anomalies" in Investor Behavior [„Anomalien" im Anlegerverhalten]; in: *Die Bank* 11, 600-607

Oehler, A. (1992), „Anomalies", Irrationalities" or „Biases" regarding the Expected Utility Theory and their Relevance for Financial Markets [„Anomalien", „Irrationalitäten" oder „Biases" der Erwartungsnutzentheorie und ihre Relevanz für Finanzmärkte]; in: *Zeitschrift für Bankrecht und Bankwirtschaft* 4, Issue 2, 97-124

Oehler, A. (1994), Behavioral Patterns of Individual Investors – an Experimental Study [Verhaltensmuster individueller Anleger - eine experimentelle Studie]; in: *Zeitschrift für betriebswirtschaftliche Forschung* 46, 939-958

Oehler, A. (1995), Explaining the Behavior of Retail Investors – Theoretical Approach and Empirical Analyses [Die Erklärung des Verhaltens privater Anleger - Theoretischer Ansatz und empirische Analysen], Betriebswirtschaftliche Abhandlungen, Neue Folge Bd. 100, Poeschel-Verlag, Stuttgart

Oehler, A. (1998a), Decreasing or Increasing Relative Risk Aversion? [Abnehmende oder zunehmende relative Risikoaversion?]; in: *Zeitschrift für Bankrecht und Bankwirtschaft* 10, Issue 4, 230-236

Oehler, A. (1998b), Analysing the Behaviour of Private Investors [Analyse des Verhaltens privater Anleger]; in: Kleeberg, J., Rehkugler, H. (Eds.), Handbuch Portfoliomanagement, Uhlenbruch-Verlag, Bad Soden/Ts, 71-110

Oehler, A. (1999), Private investor behavior in Germany: An empirical survey and experimental results; in: Bühler,W. (Eds.), Empirical Research on the German Capital Market, Springer-Verlag, Berlin, 55-77

Oehler, A. (2000a), Behavioral Finance – a Trend or more? [Behavioral Finance - Mode oder mehr?] *Die Bank* 10/2000, 718-724

Oehler, A. (2000b), Behavioral Finance – Theoretical, Empirical and Experimental Results [Behavioral Finance - Theoretische, empirische und experimentelle Befunde unter Marktrelevanz], in: *Bank-Archiv* 48, Issue 11, 978-989

Oehler, A. (2000c) The European Financial and Stock Market System – Structural Changes and Development Trends [Das europäische Finanz- und Börsenwesen - Strukturveränderungen und Entwicklungstendenzen] Vortrag, 12. Wirtschaftsforum, Berlin, 17. März 2000

Oehler, A. (2000d) Stock Markets in Competition – An Economic Analysis [Wertpapierbörsen im Wettbewerb - eine ökonomische Analyse]. Sparkasse 8/2000, 351-357

Oehler, A. (2001a), Home Bias; in : *Unternehmer-Magazin* 49, Issue 5, 50

Oehler, A. (2001b), Loss Aversion [Verlustaversion]; in: *Unternehmer-Magazin* 49, Issue 4, 50

Oehler, A. (2001c), Xetra; in: Bühner, R. (Eds.), Management-Lexikon, Oldenbourg-Verlag, München, 889-890

Oehler, A. (2002), Behavioral Finance, Behavioral Financial Market Research and Portfolio Management [Behavioral Finance, verhaltenswissenschaftliche Finanzmarktforschung und Portfoliomanagement]; in: Kleeberg, J., Rehkugler, H. (Eds.), Handbuch Portfoliomanagement, 2nd ed., Uhlenbruch-Verlag, Bad Soden/Ts, 843-870

Oehler, A. (2004), Investor Protection in a Market- and Intermediary-Based System - An Analysis in the Light of New Institutional Economics, Theory of Financial Intermediation and Behavioral Economics & Finance [Anlegerschutz in einem markt- und intermediärbasierten System - Eine Analyse im Lichte der Neuen Institutionenökonomik, der Theorie der Finanzintermediation und der Behavioral Economics & Finance]; in*: BAFIFO - Bank- und Finanzwirtschaftliche Forschung*, No. 28, Diskussionsbeiträge des Lehrstuhls für BWL, insbes. Finanzwirtschaft, Universität Bamberg, Bamberg

Oehler, A. (2005a), How Customers Perceive and Organize their Options in Public Pension Systems [Die Wahrnehmung und Gestaltung von Handlungspositionen in öffentlich-rechtlichen Alterssicherungssystemen aus Sicht der Nachfrager]; in: Heidenreich, M., Micklitz, H.-W., Oehler, A., Rattinger, A., Schwarze, J. (Eds.), Europa nach der Osterweiterung, Europaforschung an der Universität Bamberg, Kadmos, Berlin, 195-211

Oehler, A. (2005b), Functions of Banks and other Financial Intermediaries under Increasing International Financial Market Integration in the light of their Social and National Significance - Corporate Governance & Control in Market and Intermediary-based Financial Systems in the Context of Personnel and Capital Cross-Interlocking [Funktion von Banken und anderer Finanzintermediäre bei zunehmender internationaler Finanzmarktintegration unter der Perspektive ihrer gesellschaftlichen und nationalstaatlichen Bedeutung - Corporate Governance & Control in markt- und intermediärbasierten Finanzsystemen im Kontext von Personal- und Kapitalverflechtungen]; in: Heidenreich, M., Micklitz, H.-W., Oehler, A., Rattinger, A., Schwarze, J. (Eds.), Europa nach der Osterweiterung, Europaforschung an der Universität Bamberg, Kadmos, Berlin, 212-223

Oehler, A. (2005c), Consumer Information as Inducement of Quality Competition [Verbraucherinformation als Motor des Qualitätswettbewerbs]; in: Verbraucherzentrale Bundesverband (Eds.), Wirtschaftsfaktor Verbraucherinformation - Die Bedeutung von Information für funktionierende Märkte, BWV, Berlin, 28-50

Oehler, A. (2006a), Bank and External Rating of Business Successions: A further Rating-approach in Practice of Finance [Banken- und externes Rating der Unternehmernachfolge: Nur ein weiterer Ratingansatz in der Praxis der Finanzwirtschaft]; in: Achleitner, A.-K., Everling, O. und Klemm, S. (Eds.), Nachfolgerating: Rating als Chance für die Unternehmensnachfolge, Gabler,Wiesbaden, 297-312

Oehler, A. (2006b), On a Holistic Concept of Consumer Protection – An Economic Perspective [Zur ganzheitlichen Konzeption des Verbraucherschutzes – eine ökonomische Perspektive]; in: *Verbraucher und Recht* 21, Issue 8, 294-300

Oehler, A. (2006c), On the Macrostructure of Financial Markets - Stock Exchanges as Competing Financial Intermediaries [Zur Makrostruktur von Finanzmärkten - Börsen als Finanzintermediäre im Wettbewerb], in: Kürsten, W. und Nietert, B. (Eds.), Kapitalmarkt, Unternehmensfinanzierung und rationale Entscheidungen, Springer-Verlag, Berlin, 75-91

Oehler, A. (2011), Behavioral Economics and Consumer Policy: Basic Considerations and Case Studies from the Field of Consumer Finance [Behavioral Economics und Verbraucherpolitik: Grundsätzliche Überlegungen und Praxisbeispiele aus dem Bereich Verbraucherfinanzen;] in: *BankArchiv* 59, 707-727

Oehler, A. (2012a), Supplier- and Consumer-friendly Advice and Information. More Investor Protection through Standardized Advisory Reports and Product Information Sheets [Anbieter- und verbrauchergerechte Beratung und Information. Mehr

Anlegerschutz durch standardisierte Beratungsprotokolle und Produktinformationsblätter], Studie im Auftrag des MLR Ministerium für Ländlichen Raum und Verbraucherschutz Baden Württemberg, des SparkassenVerband Baden-Württemberg, des Baden-Württembergischen Genossenschaftsverband e.V., Bamberg/Stuttgart 2012

Oehler, A. (2012b), Loss at the moment of contract close? The End of the Beginning of a Provision: Damages running into Billions due to misguided Completions of Whole Life Insurance and Pensions Insurance Policies [Bei Abschluss: Verlust? Das Ende vom Anfang einer Vorsorge: Milliardenschäden durch fehlgeleitete Abschlüsse von Kapitallebens- und Rentenversicherungen]; in: *VuR Verbraucher und Recht* 27, 429-433

Oehler, A. (2012c), The Consumers' Reality: More than 50 Billion Euro Damage at Pension Provisions and Consumer Finances per year [Die Verbraucherwirklichkeit: Mehr als 50 Milliarden Euro Schäden jährlich bei Altersvorsorge und Verbraucherfinanzen]. Befunde, Handlungsempfehlungen und Lösungsmöglichkeiten, Gutachten im Auftrag der Bundestagsfraktion Bündnis 90 Die Grünen, Berlin/Bamberg, Dezember 2012

Oehler, A. (2012d), Clear, Easy, Comprehensible and Comparable: Opportunities for Standardized Product Information for all Financial Services. An Empirical Analysis [Klar, einfach, verständlich und vergleichbar: Chancen für eine standardisierte Produktinformation für alle Finanzdienstleistungen. Eine empirische Analyse]; in: *Zeitschrift für Bankrecht und Bankwirtschaft* 24, 119-133

Oehler, A. (2012e), „No money, no fun – How Young People think about Money and Finances" / „Types for the Show„ [„Ohne Moos nix los - Wie junge Menschen über Geld und Finanzen denken" / „Typen für die Sendung"], WDR, Köln

Oehler, A. (2012f), On the Misery of Misguided Whole Life Insurances and Private Pensions Insurance Policies by Consumers: Problems and Proposed Solutions [Zur Misere fehlgeleiteter Abschlüsse von Kapitallebens- und privaten Rentenversicherungen durch Verbraucher: Problemlage und Lösungsvorschläge], Hintergrundpapier vom 06.11.2012, Verbraucherkommission Baden-Württemberg, Stuttgart

Oehler, A. (2013a), Labeling & Co – Signpost, Deception or Competition Incentive? [Labeling & Co – Wegweiser, Irreführung oder Wettbewerbsanreiz?]; in: *EMF Spectrum* 3, 31-34

Oehler, A. (2013b), Minimum Standards for Social and Ecological Investments. A Study for the Development of Requirements [Mindeststandards sozial-ökologischer Geldanlagen. Studie zur Erarbeitung eines Anforderungskatalogs], zeppelin universität - Forschungszentrum Verbraucher, Markt und Politik | CCMP und des MLR Ministerium für Ländlichen Raum und Verbraucherschutz Baden Württemberg, Bamberg/Stuttgart

Oehler, A. (2013c), New Old Consumer Guiding Principles: Basis for Consumer Education? [Neue alte Verbraucherleitbilder: Basis für die Verbraucherbildung?]; in: *Haushalt in Bildung und Forschung* 2, 44-60

Oehler, A. (2013d), Consumers and Economics: Model Worlds or Reality? – Role Models, Myths and Solutions [Verbraucher und Wirtschaft: Modellwelten oder Realität? Lei d (t) bilder, Mythen und Lösungen]; in: *Journal für Verbraucherschutz und Lebensmittelsicherheit* 8, 234-240

Oehler, A. (2014a), Testing the Testers?: Generally Accepted Testing Principles! [Testen der Tester?: Grundsätze ordnungsgemäßen Testens!]; in: *Wirtschaftsdienst* 94, Issue 6, 444-447

Oehler, A. (2014b), Considerations on a Minimum Standard for Social and Ecological Investments [Überlegungen zu einem Mindeststandard für sozial-ökologische Geldanlagen] (SÖG); in: *Journal für Verbraucherschutz und Lebensmittelsicherheit* 9, 251-255

Oehler, A., (2014c), Interest on Credit Facilities: Solutions and Recommendations [Zinsen für Dispositionskredite: Lösungsansätze und Handlungsempfehlungen], Stellungnahme der Verbraucherkommission Baden-Württemberg

Oehler, A. (2015a), Everything Digital? Innovative Business Models in Digital Payment Transactions and Consumer Policy [Alles digital? Innovative Geschäftsmodelle im digitalen Zahlungsverkehr und Verbraucherpolitik]; in: *Wirtschaftsdienst*, Dezember 2015, 817-821

Oehler, A. (2015b), Digital Finance, Payment Services and Financial Advice under a Digital Agenda, [Digitale Welt und Finanzen. Zahlungsdienste und Finanzberatung unter einer Digitalen Agenda] Veröffentlichungen des Sachverständigenrats für Verbraucherfragen, Berlin

Oehler, A. (2015c), Nudging; in: *Wirtschaftswissenschaftliches Studium* 44, 590-593

Oehler, A. (2015d), Financial Preventions: Does Every New Beginning Hold its Own Magic? [Privat vorsorgen: Wohnt jedem Anfang ein Zauber inne?] Conference Presentation at Interdisziplinärer Workshop Private Altersvorsorge, Universität Gießen / Universität Marburg

Oehler, A. (2015e), Risk Warning Labels in Brief Information for Financial Services [Risiko-Warnhinweise in Kurzinformationen für Finanzdienstleistungen]. Eine empirische Analyse, ZBB Zeitschrift für Bankrecht und Bankwirtschaft 27, 2015, 208-212

Oehler, A. (2016a), Opportunities for Self-determined Data Utilization?! [Chancen der selbstbestimmten Datennutzung?!]; in: *Wirtschaftsdienst* 2016, November, 830-832

Oehler, A. (2016b), Digital Financial Advice needs Standardized Product Information [Digitale Finanzberatung braucht standardisierte Produktinformationen], in*: Der Neue Finanzberater* 1, 15

Oehler, A. (2016c), Digital World and Finance. Results and Recommendations [Digitale Welt und Finanzen. Ergebnisse und Handlungsempfehlungen], Veröffentlichungen des Sachverständigenrats für Verbraucherfragen, Berlin 2016

Oehler, A. (2016d), Digital World and Finance. Types of Crowdfunding: Need for Action for Consumer Policy? [Digitale Welt und Finanzen. Formen des Crowdfunding: Handlungsbedarf für die Verbraucherpolitik?] Veröffentlichungen des Sachverständigenrats für Verbraucherfragen, Berlin 2016

Oehler, A. (2017a), Technological Change: Challenges in the Digital World [Der technologische Wandel: Herausforderungen in der Digitalen Welt]; in: Kenning, P., Oehler, A., Reisch, L., Grugel, C. (Eds.), Verbraucherwissenschaften - Rahmenbedingungen, Forschungsfelder und Institutionen, Springer, Wiesbaden, 69-80

Oehler, A. (2017b), Future Directions for Consumer Science. [Entwicklungspfade der Verbraucherwissenschaften]; in: Kenning, P., Oehler, A., Reisch, L., Grugel, C. (Eds.), Verbraucherwissenschaften -Rahmenbedingungen, Forschungsfelder und Institutionen, Springer, Wiesbaden, 19-30

Oehler, A., (2017c), Personal Finance and Retirement Savings [Finanzen und Altersvorsorge]; in: Kenning, P., Oehler, A., Reisch, L., Grugel, C. (Eds.), Verbraucherwissenschaften - Rahmenbedingungen, Forschungsfelder und Institutionen, Springer, Wiesbaden, 191-210

Oehler, A. (2017d), Principles of correct Scoring [Grundsätze ordnungsgemäßer Bewertung durch Scoring]; in *Wirtschaftsdienst* 2017, Oktober, 748-751

Oehler, A., (2017e), Consumer Information and Consumer Literacy [Verbraucherinformation und Verbraucherbildung]; in: Kenning, P., Oehler, A., Reisch, L., Grugel, C. (Eds.). Verbraucherwissenschaften - Rahmenbedingungen, Forschungsfelder und Institutionen, Springer, Wiesbaden, 279-294

Oehler, A. (2018), Information for the Crowd: Do Asset Informations Sheets Provide Good Information for Retail Investors? – An Empirical Examination [Infos für den Schwarm: Werden Crowdinvesting-Kleinanleger mit VIBs gut informiert? Eine empirische Untersuchung], im Auftrag der zeppelin universität – Forschungszentrum Verbraucher, Markt und Politik | CCMP und des MLR Ministerium für Ländlichen Raum und Verbraucherschutz (MLR) Baden Württemberg, Bamberg/Stuttgart

Oehler, A., Heilmann, K., Läger, V. (2000), Do Insiders Contribute to Market Efficiency? Informational Efficiency and Liquidity of Experimental Call Markets with and without Insiders; in: *BAFIFO - Bank- und Finanzwirtschaftliche Forschung*, No. 11, Diskussionsbeiträge des Lehrstuhls für BWL, insbes. Finanzwirtschaft, Universität Bamberg, Bamberg

Oehler, A., Heilmann, K., Läger, V. (2001), Discovering the Best: Informational Efficiency and Liquidity of Alternative Trading Mechansims in Experimental Asset Markets in: *BAFIFO - Bank- und Finanzwirtschaftliche Forschung*, No. 18, Diskussionsbeiträge des Lehrstuhls für BWL, insbes. Finanzwirtschaft, Universität Bamberg, Bamberg

Oehler, A., Heilmann, K., Läger, V., Oberländer, M. (2003), Coexistence of disposition investors and momentum traders in stock markets: Experimental evidence; in: *Journal of International Financial Markets, Institutions & Money* 13, Issue 5, 503-524

Oehler, A., Herberger, T., Höfer, A., Wendt, S. (2015), Risk Assessment and Risk Management in Economics; in: Micklitz, H.-W. Tridimas, T. (Eds.), Risk and the EU Law, Elgar, Cheltenham, 33-48,

Oehler, A., Herberger, T., Horn, M, Schalkowski, H. (2017), IPOs, the Level of Private Equity Engagement and Stock Performance Matters: Empirical Evidence from Germany; in: *Corporate Ownership & Control* 15, Issue 1, 72-82

Oehler, A., Herberger, T., Horn, M. (2018), Initial Public Offerings in Germany between 1997 and 2015; in: Cumming, D. (Ed.), Oxford Handbook on IPOs, forthcoming.

Oehler, A., Höfer, A., Horn, M., Wendt, S. (2018), Do Mutual Fund Ratings Provide Valuable Information for Retail Investors?; in: *Studies in Economics and Finance* 35, Issue 1, 137-152

Oehler, A., Höfer, A., Schalkowski, H., Wendt, S. (2011), Erratic Behavior of Buy-Side-Analysts? Application of Forensic Activities in Risk Management [Fehlverhalten von Buy-Side-Analysten? Anwendung forensischer Aktivitäten im Risikomanagement], BIT Banking and Information Technology 12, 25-31

Oehler, A., Höfer, A., Wendt, S. (2013), Credit Facilities: Missing Credit Analysis costs Consumers a Lot of Money – Solutions and Recommendation [Dispositionskredite: Fehlende Bonitätsprüfung kostet Verbraucher viel Geld - Lösungsansätze und Handlungsempfehlung]; in: *ZBB Zeitschrift für Bankrecht und Bankwirtschaft* 25, 350-357

Oehler, A., Höfer, A., Wendt, S. (2014), Do Key Investor Information Documents Enhance Retail Investors' Understanding of Financial Products? Empirical Evidence; in: *Journal of Financial Regulation and Compliance* 22, 115-127

Oehler, A., Horn, M. (2016), Does Households' Wealth Predict the Efficiency of their Asset Mix? Empirical Evidence; Conference Paper at 2018 FMA Annual Meeting, San Diego, October 10-13, 2018; SABE/IAREP Conference, London, July 19-22, 2018; 53rd Meeting of the Eastern Finance Association (EFA), Jacksonville, April 5-8, 2017; Acadamy of Behavioral Finance & Economics Conference 2017, Stuttgart, March 15-17, 2017; Research in Behavioral Finance Conference 2016, Amsterdam, September 15-16

Oehler, A., Horn, M. (2018), Behavioral Portfolio Theory Revisited: Lessons Learned from the Field; Conference Paper at 11th Annual Meeting of The Academy of Behavioral Finance & Economics, Chicago, October 17-20, 2018; 2018 Behavioural Finance Working Group Conference, London, June 14-15, 2018; 54th Meeting of the Eastern Finance Association (EFA), Philadelphia, April 11-14, 2018.

Oehler, A., Horn, M., Wedlich, F. (2018), Young Adults' Subjective and Objective Risk Attitude in Financial Decision Making: Evidence from the Lab and the Field; in: *Review of Behavioral Finance (forthcoming)*

Oehler, A., Horn, M., Wendt, S. (2016a), Benefits from social trading? Empirical evidence for certificates on wikifolios; in: *International Review of Financial Analysis* 46, 202-210

Oehler, A., Horn, M., Wendt, S. (2016b), Digital Payment Services: Chinese Walls 2.0 or Separation? [Digitale Zahlungsdienste: Chinese Walls 2.0 oder Trennung?], DIVSI Magazin, Oktober 2016, 23-25

Oehler, A., Horn, M., Wendt, S. (2016c), Retail Investors in the Digital World [Nicht-professionelle Investoren in der digitalen Welt]; Wirtschaftsdienst, September 2016, 640-644.

Oehler, A., Horn, M., Wendt, S. (2016d), What are the Real Benefits of Robo-Advice? [Was taugt die Finanzberatung durch Robo-Advisors wirklich?]; in: *Der Neue Finanzberater* 2016, Issue 2, 28-29

Oehler, A., Horn, M., Wendt, S. (2017a), Brexit: Short-term Stock Price Effects and the Impact of Firm-level Internationalization; in: *Finance Research Letters* 22, 175-181

Oehler, A., Horn, M., Wendt, S., (2017b), Retail Investors Discover the Digital World [Nicht-professionelle Investoren entdecken die digitale Welt]; in: *Bankmagazin* 2017, Issue 1, 26-29

Oehler, A., Horn, M., Wendt, S. (2017c), Social Trading: Tracking the Performance [Social Trading: Der Performance auf der Spur]; in: *Jahrbuch 2017/2018 des Finanzplatz Hamburg e.V.*, 10-11.

Oehler, A., Horn, M. Wendt, S. (2018a), New Business Models through Digitization? An Analysis of Current Developments at Financial Services [Neue Geschäftsmodelle durch Digitalisierung? Eine Analyse aktueller Entwicklungen bei Finanzdienstleistungen]; in: Keuper, F., Schomann, M., Sikora L.I., Wassef, R. (Eds.), Disruption and Transformation Management, 325-341

Oehler, A., Horn, M., Wendt, S. (2018b), More than „just" Crowdfunding: How Digitization Changes the Process of Financing Small and Medium-sized Companies [Mehr als „nur" Crowdfunding: Wie die Digitalisierung Prozesse der Mittelstandsfinanzierung verändert]; in: *Corporate Finance* 9, Issue 1-2, 3-7

Oehler, A., Horn, M., Wendt, S. (2018c), Why self-commitment is not enough: On a regulated minimum standard for ecologically and socially responsible financial products and services; in: Walker, T., Kibsey, S., Crichton, R. (Eds.), Designing a Sustainable Financial System: Development Goals and Socio-Ecological Responsibility, 405-421

Oehler, A., Horn, M., Wendt, S., Reisch, L., Walker, T., (2018), Young adults and their finances: An international comparative study on applied financial literacy; in: *Economic Notes* 47, Issue 2-3, 305-330

Oehler, A., Kenning, P. (2013), Enabling Evidence! On the Way to a Realistic and Empirically based Consumer Policy [Evidenzbasierung ermöglichen! Auf dem Weg zu einer realitätsnahen und empirisch fundierten Verbraucherpolitik], Stellungnahme des Wissenschaftlichen Beirats Verbraucher- und Ernährungspolitik beim BMELV, Berlin 2013

Oehler, A., Kohlert, D. (2009), Financial advice Giving and Taking - Where are the Market's Self-healing Powers and a Functioning Legal Framework When We Need Them; in: *Journal of Consumer Policy* 32, 91-116

Oehler, A., Pukthuanthong, K., Walker, T., Wendt, S. (2016), Insider Stock Trading and the Bond Market; in: *The Journal of Fixed Income* 25, Issue 3, 74-91

Oehler, A., Reisch, L. (2008), Behavioral Economics – a new basis for Consumer Policy? [Behavioral Economics - eine neue Grundlage für die Verbraucherpolitik?] Studie im Auftrag des vzbv e.V., Berlin

Oehler, A., Reisch, L. A. (2012), It is alive! Consumer Research in German-speaking Countries: An empirical Analysis [Sie lebt! Zur Verbraucherforschung im deutschsprachigen Raum: Eine empirische Analyse]; in: *Journal für Verbraucherschutz und Lebensmittelsicherheit* 7, 105-115

Oehler, A., Rummer, M., Walker, T., Wendt, S. (2007), Are investors home biased? Evidence from Germany; in: Gregoriou, G. N. (Ed.), Diversification and Portfolio Management of Mutual Funds, Palgrave MacMillan, Houndmills, 55-77

Oehler, A., Rummer, M. Wendt, S. (2008), Portfolio selection of German investors: On the causes of home-biased investment decisions; in: *Journal of Behavioral Finance* 9, Issue 3, 149-162

Oehler, A., Schalkowski, H. (2013), Private Equity Investments and Stewardship Theory - A Process-oriented Analysis of the Relationship between Private Equity Firms and Investment Companies [Private-Equity-Beteiligungen und Stewardship-Theorie – Eine prozessorientierte Analyse des Beziehungsgeflechts zwischen Private-Equity-Gesellschaften und Beteiligungsunternehmen], in: *BFuP Betriebswirtschaftliche Forschung und Praxis 65*, Issue 5 , 534-544

Oehler, A., Schalkowski, H., Wedlich, F. (2015), The Pre-M&A Process: Can the Corporate Governance's Configuration Contribute to an Effective Restriction of Overconfidence? [Der Pre-M&A-Prozess: Kann die Ausgestaltung der Corporate Governance zu einer wirksamen Einschränkung von Overconfidence beitragen?]; in: Wollersheim, J., Welpe, I. (Eds.), Forum Mergers & Acquisitions 2014, Springer, Wiesbaden, 403-419

Oehler, A., Schalkowski, H., Wendt, S. (2011), The Threat of Economic Crime to SMEs' Sustainability - Starting Points for Detection and Prevention by Forensic Economics & Finance [Gefährdung der Nachhaltigkeit von KMU durch

Wirtschaftskriminalität - Ansatzpunkte zur Aufdeckung und Vorbeugung durch Forensic Economics & Finance]; in: Meyer, J.-A. (Ed.), KMU-Jahrbuch 2011, Josef Eul Verlag, Lohmar, 367-382

Oehler, A., Schalkowski, H., Wendt, S. (2012a), Forensic Economics, Finance & Accounting. Expansion and Implementation of Corporate Governance regarding Economic Crimes [Forensic Economics, Finance & Accounting. Erweiterung bzw. Durchsetzung von Corporate Governance im Hinblick auf wirtschaftskriminelle Handlungen], in: *ZCG Zeitschrift für Corporate Governance* 7, 5-10

Oehler, A., Schalkowski, H., Wendt, S. (2012b), Human Resource and Risk Management at SMEs – An Approach for an Integration [Personal- und Risikomanagement in KMU - Ein Ansatz zur Integration]; in: Meyer, J.-A. (Ed.), KMU-Jahrbuch 2012, Josef Eul Verlag, Lohmar, 407-417

Oehler, A., Schalkowski, H., Wendt, S. (2013), Personal and Automated Communication in SMEs: An Approach to Manage the Increased Complexity of Communication Processes [Persönliche und automatisierte Kommunikation in KMU: Ein Ansatz zum Management gestiegener Komplexität von Kommunikationsprozessen]; in: Meyer, J.-A. (Ed.), KMU-Jahrbuch 2013, Josef Eul Verlag, Lohmar, 105-122

Oehler, A., Schalkowski, H., Wendt, S. (2014), Environment Management: Managing the Environment or Managing in and with the Environment? Considerations on an integrated Management-approach [Umweltmanagement: Management der Umwelt oder Management in und mit der Umwelt? Überlegungen zu einem integrativen Managementansatz]; in: Meyer, J.-A. (Ed.), KMU-Jahrbuch 2014, Josef Eul Verlag, Lohmar, 79-108

Oehler, A., Stellpflug, J., 2015, Existential Prevention in Personal Finance [Daseinsvorsorge bei Verbraucherfinanzen], Stellungnahme der Verbraucherkommission Baden-Württemberg, Nr. 37, Stuttgart

Oehler, A., Unser, M. (2002), Financial Risk Management [Finanzwirtschaftliches Risikomanagement], 2nd ed., Springer-Verlag, Berlin a.o.

Oehler, A., Walker, T., Wendt, S. (2013), Effects of Election Results on Stock Price Performance: Evidence from 1980 to 2008; in: *Managerial Finance* 39, Issue 8, 714-736

Oehler, A., Wedlich, F. (2018), Influence of Extraversion and Neuroticism on Risk Attitude, Risk Perception and Return Expectations; in: *Journal of Neuroscience, Psychology, and Economics* (forthcoming)

Oehler, A., Wedlich, F., Wendt, S., Horn, M. (2016), Does personality drive price bubbles?; Conference Paper at 2016 FMA Annual Meeting, Las Vegas, October 19-22, 2016; 30th Annual Meeting of The Academy of Financial Services, Las Vegas, October 20-21, 2016; Research in Behavioral Finance Conference 2016, Amsterdam, September 15-16; 23rd Annual Conference of the Multinational Finance Society, Stockholm, June 26-29, 2016; 2016 Behavioural Finance Working Group Conference, London, June 13-14, 2016; 14.HVB-Stiftung Forschungsseminar,

Riederau am Ammersee, June 3-4, 2016; 78. Jahrestagung des Verband der Hochschullehrer für Betriebswirtschaft (VHB), München, April 18-20, 2016; 52nd Meeting of the Eastern Finance Association (EFA), Baltimore, April 6-9, 2016.

Oehler, A., Wendt, S. (2007), Governance-Struktur und -Mechanismen von Investmentfonds; in: Oehler, A. (Ed.), Risikomanagement für Investmentfonds und Hedge Funds - Status quo vadis?, Springer-Verlag/BankVerlag, Wien, 120-161

Oehler, A., Wendt, S. (2016a), Everything International: Are Index Investments more than naive Diversification? [Alles international: Sind Index-Investments mehr als naive Diversifikation?]; in: Eckert, S., Trautnitz, G. (Eds.), Internationales Management und die Grundlagen des globalisierten Kapitalismus, Festschrift für Prof. Dr. Johann Engelhard, Springer, Berlin 2016, 219-229

Oehler, A., Wendt, S. (2016b), Business Ethics in Practice: Minimum Standards for Social and Ecological Investments? [Wirtschaftsethik praktisch: Mindeststandards für sozialökologische Geldanlagen (SÖG)?]; in: Eckert, S., Trautnitz, G. (Eds.), Internationales Management und die Grundlagen des globalisierten Kapitalismus, Festschrift für Prof. Dr. Johann Engelhard, Springer, Berlin, 395-439
Opper, S. (2001), Der Stand der Neuen Institutionenökonomik; in: *Wirtschaftsdienst*, Issue 10, 601-608

Oehler, A., Wendt, S. (2017), Good Consumer Information: the Information Paradigm at its (Dead) End?; in: *Journal of Consumer Policy* 40, Issue 2, 179-191

Oehler, A., Wendt, S., Horn, M. (2016), Internationalization of Blue-Chip versus Mid-Cap Stock Indices: an Empirical Analysis for France, Germany, and the UK; in: *Atlantic Economic Journal* 44, December, 501-518

Oehler, A., Wendt, S., Horn, M. (2017), Are Investors Really Home-Biased when Investing at Home?; in: *Research in International Business and Finance* 40, 52-60

Oehler, A., Wendt, S., Horn, M. (2018), Does Firms' Disclosure of Operational Risk Help Explain Stock Returns? Evidence from German Non-financial Firms, Working Paper Reykjavik University

Oehler, A., Wendt, S., Wedlich, F., Horn, M. (2018), Investors' Personality Influences Investment Decisions: Experimental Evidence on Extraversion and Neuroticism; in: *Journal of Behavioral Finance* 19, Issue 1, 30-48

Oehler, A., Werner, C. (2008), Saving for Retirement - a Case for Financial Education in Germany and UK? An Economic Perspective; in: *Journal of Consumer Policy* 31, 253-283

Opper, S. (2001), The Status of New Institutional Economics [Der Stand der Neuen Institutionenökonomik]; in: *Wirtschaftsdienst*, Issue 10, 601-608

Palsson, A-M. (1996), Does the degree of relative risk aversion vary with household characteristics?; in: *Journal of Economic Psychology* 17, Issue 6, 771-787

Paya, I., Wang, P. (2016), Wealth fluctuations and investment in risky assets: The UK micro evidence on households' asset allocation; in: *Journal of Empirical Finance* 38, Part A, September 2016, 221-235

Perold, A. (2004), The Capital Asset Pricing Model; in: *Journal of Economic Perspectives* 18, Issue 3, 3-24

Perold, A. F., Sharpe, W. F. (1988), Dynamic Strategies for Asset Allocation; in: *Financial Analysts Journal* 44, Issue 1, 16-27

Perridon, L., Steiner, M., Rathgeber, A. (2009), Corporate Finance [Finanzwirtschaft der Unternehmung]. 15.Auflage, Verlag Franz Vahlen, München.

Pézier, J., White, A. (2006), The Relative Merits of Investable Hedge Fund Indices and of Funds of Hedge Funds in Optimal Passive Portfolios. ICMA Centre Discussion Papers in Finance DP2006-10

Pfiffelmann, M., Roger, T., Bourachnikova, O. (2016), When Behavioral Portfolio Theory meets Markowitz theory, in: *Economic Modelling* 53, 419-435

Picot, A., Dietl, H., Egon, F., Fiedler, M., Royer, S. (2015), Organization: Theory and Practice from an Economic Point of View [Organisation: Theorie und Praxis aus ökonomischer Sicht], 7. Auflage, Schäffer-Poeschel Verlag, Stuttgart

Picot, A., Dietl, H. (1990), Transaction Cost Theory [Transaktionskostentheorie]; in: W*irtschaftswissenschaftliches Studium* 19, Issue 4, 178-184

Pliska, S. R., Suzuki, K. (2004), Optimal Tracking for Asset Allocation with Fixed and Proportional Transaction Costs; in: *Quantitative Finance* 4, Issue 2, 233-43

Powell, M., Ansic, D. (1997), Gender differences in risk behaviour in financial decision-making: An experimental analysis; in: *Journal of Economic Psychology* 18, Issue 6, 605-628

Pratt, J. (1964), Risk Aversion in the Small and the Large; in: *Econometrica* 32, Issue 1/2, 122-136

Puri, M., Robinson, D. (2007), Optimism and Portfolio Choice; in: *Journal of Financial Economics* 86, Issue 1, 71-99

Reisch, L., Oehler, A. (2009), Behavioral Economics: Eine neue Grundlage für die Verbraucherpolitik?; in: *DIW Vierteljahreshefte zur Wirtschaftsforschung* 78, Issue 3, 30-43

Rengifo, E. Trendafilov, R., Trifan, E. (2014), Behavioral Portfolio Theory and Investment Management; in: Baker, H. K., Ricciardi, V. (Eds.), Investor Behavior: The Psychology of Financial Planning and Investing, Wiley, Hoboken, 25-41

Ricciardi, V. (2008), Risk: Traditional Finance versus Behavioral Finance; in: Fabozzi, F. (Ed.), The Handbook of Finance, Volume 2, Wiley, Hoboken, 11-38.

Richter, R. (1990), Perspective and Questions of the New Institutional Economics [Sichtweise und Fragestellungen der neuen Institutionenökonomik]; in: *Zeitschrift für Wirtschafts- und Sozialwissenschaften* 110, Issue 4, 571-591

Richter, R., Furubotn, E. (1999), New Institutional Economics [Neue Institutionenökonomik]. „. Auflage, Mohr Siebeck, Tübingen.

Riley Jr., W. B., Chow, K. V. (1992), Asset Allocation and Individual Risk Aversion; in: *Financial Analyst Journal* 48, Issue 6, 32-37

Roy, A. D. (1952), Safety-First and the Holding of Assets; in: *Econometrica* 20, Issue 3, 431-449

Ross, S. (1976), The Arbitrage Theory of Capital Asset Pricing; in: *Journal of Economic Theory* 13, Issue 3, 341-360

Rowland, P. F. (1999), Transaction Costs and International Portfolio Diversification; in: *Journal of International Economics* 49, Issue 1, 145-170

Rubinstein, M. (2002), Markowitz's "Portfolio Selection": A Fifty-Year Retrospective; in: *Journal of Finance* 62, Issue 3, 1041-1045

Sahm, C.R. (2012), How much does risk tolerance change?; in: *Quarterly Journal of Finance* 2, Issue 4, available at http://dx.doi.org/10.1142/S2010139212500206 (accessed at 05 May 2017)

Schalkowski, H., (2013), Contracted-based Influence of Private-Equity-Companies on the Corporate Governance of their Affiliated Companies [Vertraglich fixierte Einflussnahme von Private-Equity-Gesellschaften auf die Corporate Governance ihrer Beteiligungsgesellschaften], Eul Verlag, Lohmar

Schmidt, R., Terberger, E. (2006), Basic Theories of Investment and Finance [Grundzüge der Investitions- und Finanzierungstheorie]. 4th ed., Gabler, Wiesbaden

Schmidt, T., Eisele, M. (n.y.), Oversampling of Wealthy Households in the Study „Private Households and their Finances" [Oversampling vermögender Haushalte im Rahmen der Studie „Private Haushalte und ihre Finanzen (PHF)"]. Available at: https://www.bundesbank.de/Redaktion/EN/Downloads/Bundesbank/Research_Centre/phf_oversampling.pdf?__blob=publicationFile

Schoemaker, P. (1982), The Expected Utility Model: Its Variants, Purposes, Evidence and Limitations; in: *Journal of Economic Literature* 20, Issue 2, 529-563

Schooley, D., Worden, D. (1996), Risk Aversion Measures: Comparing Attitudes and Asset Allocation; in: *Financial Services Review* 5, 87-99

Scott, R., Horvath, P. (1980), On the Direction of Preference for Moments of Higher Order than the Variance; in: *Journal of Finance* 35, Issue 4, 915-919

Seru, A., Shumway, T., Stoffman, N. (2010), Learning by Trading; in: *Review of Financial Studies* 23, 705-739

Sharpe, W. F. (1964), Capital asset prices: A theory of market equilibrium under conditions of risk; in: *The Journal of Finance* 19, Issue 3, 425-442

Sharpe, W. F. (1966), Mutual Fund Performance; in: *Journal of Business* 39, Issue 1, 119-138

Sharpe, W. F. (1994), The Sharpe Ratio; in: *Journal of Portfolio Management* 21, Issue 1, 49-58

Sharpe, W., Alexander, G., Bailey, J. (1995), Investments, Prentice Hall, Princeton

Shefrin, H. M. und Statman, M. (1985), The disposition to sell winners too early and ride losers too long: Theory and evidence; in; *The Journal of Finance* 40, Issue 3, 777-792

Shefrin, H. M., Statman, M. (2000), Behavioral Portfolio Theory; in: Journal *of Financial and Quantitative Analysis* 35, Issue 2, 127-151

Shefrin, H., Thaler, R. (1988), The Behavioral Life-Cycle Hypothesis, in: E*conomic Inquiry* 26, Issue 4, 609-643

Shiller, R. (1999), Human Behavior and the Efficiency of the Financial System; in: Taylor, J. B., Woodford, M. (Eds.), Handbook of Macroeconomics 1, 1305-40

Shiller, R. (2003), From Efficient Markets Theory to Behavioral Finance; in: *Journal of Economic Perspectives* 17, Issue 1, 83-104

Shiller, R. (2014) Speculative Asset Prices, in: *American Economic Review* 104, Issue 6, 1486-1517

Shiller, R. J., Kon-Ya, F., Tsutsui, Y. (1991), Speculative Behavior in the Stock Markets, Working Paper, National Bureau of Economic Research, Cambridge

Siegel, F.W., Hoban Jr., J. P. (1982), Relative Risk Aversion Revisited, in: *The Review of Economics and Statistics* 64, Issue 3, 481-487

Siegel, F.W., Hoban Jr., J. P. (1991), Measuring Risk Aversion:Allocation, Leverage, and Accumulation, in: *Journal of Financial Research* 14, Issue 1, 27-35

Siegel, J, Thaler, R. (1997), Anomalies: The Equity Premium Puzzle; in: *Journal of Economic Perspectives* 11, Issue 1, 191-200

Simon, H. A. (1955), A Behavioral Model of Rational Choice; in: *The Quarterly Journal of Economics* 69, 99-118

Simon, H.A. (1956), Rational Choice and the Structure of Environments; in: *Psychological Review* 63, 129-138

Smith, K., Dickhaut, J., McCabe, K., Pardo, J. (2002), Neuronal Substrates for Choice Under Ambiguity, Risk, Gains, and Losses; in: *Management Science* 48, Issue 6, 711-718

Stark, J. (2018), Decomposing mutual fund alpha into security selection and security weighting. Conference Paper at Eastern Finance Association Annual Meetings Philadelphia, April 11-14, 2018

Solnik, B. (1974). The international pricing of risk: An empirical investigation of the world capital market structure; in: *Journal of Finance* 29, Issue 2, 365-378

Spieß, E. (2005), Business Psychology: Framework, Concepts, Fields of Application [Wirtschaftspsychologie: Rahmenmodell, Konzepte, Anwendungsfelder], Oldenbourg Wissenschaftsverlag, München

Statman, M. (1987), How Many Stocks Make a Diversified Portfolio; in: *Journal of Financial and Quantitative Analysis* 22, Issue 3, 353-363

Staman, M. (2002), How much diversification is enough? Working Paper available at SSRN: https://ssrn.com/abstract=365241

Statman, M. (2014), Behavioral finance: Finance with normal people; in: *Borsa Istanbul Review* 14, 65-73

Statman, M. (2017), Finance for normal people: how investors and markets behave, Oxford University Press, New York

Steiner, M., Bruns, C. (2007), Investment Management [Wertpapiermanagement]. 9. Auflage, Schäffer-Poeschel Verlag, Stuttgart

Strünck, C., Arens-Azevêdo, U., Brönneke, T., Hagen, K., Jaquemoth, M., Kenning, P., Liedtke, C., Oehler, A., Schrader, U., Tamm, M. (2012), Is the "Responsible Consumer" a Myth? Towards a Realistic Consumer Policy [Ist der „mündige Verbraucher“ ein Mythos? Auf dem Weg zu einer realistischen Verbraucherpolitik], Stellungnahme des Wissenschaftlichen Beirats Verbraucher- und Ernährungspolitik beim BMELV, Berlin 2012

Strünck, C., Hagen, K., Micklitz, H.-W., Oehler, A., Reisch, L (2013), What Benefits offers Consumer Policy to Consumers? Plea for a Systematic Evidence-based Consumer Policy [Was nützt die Verbraucherpolitik den Verbrauchern? Plädoyer für eine systematische Evidenzbasierung der Verbraucherpolitik]; in: *WISO direkt*, 4/2013, 1-4

Stoll, H. (2003), Market Microstructure; in: Constantinides, G. M., Harris, M., Stulz, R. M (Eds.), Handbook of the Economics of Finance 1, Part A, 553-604

Sunden, A., Surette, B. (1998), Gender Differences in the Allocation of Assets in Retirement Savings Plans; in: *American Economic Review* 88, Issue 2, 207-211

Tesar, L. L., Werner, I. M. (1992), Home Bias and Globalization of Securities Markets; in: *National Bureau of Economic Research*, Cambridge

Tesar, L. L., Werner, I. M. (1994), International Equity Transactions and U.S. Portfolio Choice; in: Frankel, J. A. (Ed.), The Internationalization of Equity Markets, University of Chicago Press, Chicago

Tesar, L. L., Werner, I. M. (1995), Home bias and high turnover; in: *Journal of International Money and Finance* 14, Issue 4, 467-492

Thaler, R. (1980) Toward a Positive Theory of Consumer Choice; in: *Journal of Economic Behavior and Organization* 1, 39-60

Thaler, R. (1985) Mental Accounting and Consumer Choice; in: *Marketing Science* 4, 3, 199-21

Thaler, R. (1990), Anomalies: Saving, Fungibility, and Mental Accounts; in: *Journal of Economic Perspectives* 4, Issue 1, 193-205

Thaler, R. (1999), Mental Accounting Matters; in: *Journal of Behavioral Decision Making* 12, Issue 3, 183-206

Thaler, R. (2016), Behavioral Economics: Past, Present, and Future; in: *American Economic Review* 106, Issue 7, 1577-1600

Theissen, E. (1998), Organizational Forms of Securities Trading: Price Determination, Continuous Auction and the Market-maker System [Organisationsformen des Wertpapierhandels: Gesamtkursermittlung, kontinuierliche Auktion und Market-Maker-System], Gabler, Wiesbaden

Titan, A. (2015), The Efficient Market Hypothesis: review of specialized literature and empirical research; in: *Procedia Economics and Finance* 32, 442-449

Tobin, J. (1958), Liquidity Preference as Behavior Towards Risk; in: *Review of Economic Studies* 25, Issue 2, 65-86

Tokat, Y., Wicas, N. (2007), Portfolio Rebalancing in Theory and Practice; in: J*ournal of Investing* 16, Issue 2, 52-59

Tracy, J., Schneider, H., Chan, S. (1999), Are stocks overtaking real estate in household portfolios?; in: *Federal Reserve Bank of New York Current Issues in Economics and Finance* 5, Issue 5, 1-6

Tsai, C. (2001), Rebalancing Diversified Portfolios of Various Risk Profiles; in: *Journal of Financial Planning, October 2001*, 104-110.

Tufano, P. (2009), Consumer Finance, in*: Annual Review of Financial Economics* 1, 227-247

Van Rooij, M. (2012), Financial Literacy, Retirement Planning and Household Wealth' in: *Economic Journal* 122, 449-478

Van Rooij, M., Lusardi, A., Alessie, R. (2011), Financial Literacy and stock market participation; in: *Journal of Financial Economics* 101, 449-472

van Rooij, M., Lusardi, A., Alessie, R. (2012), Financial literacy, retirement planning, and wealth accumulation; in*: Economic Journal* 122, Issue 560, 449-478

Vayanos, D., Wang, J. (2013), Market Liquidit -- Theory and Empirical Evidence, in: Constantinides, G. M., Harris, M., Stulz, R. M. (Eds.), Handbook of the Economics of Finance 2, Part B, 1289-1360

Vissing-Jørgensen, A. (2002), Limited asset market participation and the elasticity of intertemporal substitution; in: *Journal of Political Economy* 110, 825-853

Vissing-Jorgensen, A. (2004), Perspectives on Behavioral Finance: Does "Irrationality" Disappear with Wealth? Evidence from Expectations and Actions; in: *NBER Macroeconomics Annual* 18, 139-194

Von Gaudecker, H.M. (2015), How Does Household Portfolio Diversification Vary with Financial Literacy and Financial Advice; in: *Journal of Finance* 70, 489-506

Von Kalckreuth, U., Eisele, M., Le Blanc, J., Schmidt, T., Zhu, J. (2012), The PHF: a comprehensive panel survey on household finances and wealth in Germany. Deutsche Bundesbank, Discussion Paper 13/2012

Von Neumann, N., Morgenstern, O. (1944), Theory of Games and Economic Behavior, Princeton University Press, Pinceton

Von Nitzsch, R., Stolz, O. (2006). How High is the Return Losses Caused by the Home Bias? [Zu welchen Renditeeinbußen führt der Home Bias?], in: *Finanz Betrieb* 8, Issue 2, 106-113

Wagner, N., Winter, E. (2013), A New Family of Equity Style Indices and Mutual Fund Performance: Do Liquidity and Idiosyncratic Risk Matter?; in: *Journal of Empirical Finance* 21, 69-85

Walker, T., Oehler, A., Thiengtham, D., Walker, M., Martens, M., Wendt, S., Arcand, J.-P. (2011), Short and Long Term Consequences of Role Changes of the Company's Founder by IPOs [Kurz- und langfristige Folgen einer Veränderung der Rolle des Gründers in Unternehmen mit IPOs]; in: *DBW Die Betriebswirtschaft* 71, Issue 1, 41-62

Wang, A.-L. (2013), Financial Communications: Information Processing, Media Integration, and Ethical Considerations, 1st ed., Palgrave Macmillan, New York.

Wedlich, F. (2017), Influence of Investors' Personality on their Risk Behavior in Financial Markets [Einfluss der Persönlichkeit auf das Risikoverhalten von Anlegern in Finanzmärkten], Tectum, Baden-Baden

Weber, M., Weber, E.U. and Nosic, A. (2013), Who takes Risks When and Why: Determinants of Changes in Investor Risk Taking; in: *Review of Finance* 17 Issue 3, 847-883

Wermers, R. (2000), Mutual fund performance: an empirical decomposition into stock-picking talent, style, transactions costs, and expenses; in: *Journal of Finance* 55, 1655-1703

Williamson, O. E. (1985): The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting, New York

Williamson, O. E. (2005), Transaction Cost Economics; in Menard, C., Shirley, M. (Eds.) Handbook of New Institutional Economics, Springer, Dordrecht, 41-65.

Wendt, S. (2011), The Effects of Corporate Governance on the Borrowing Costs of Companies – An Empirical Analysis of the Consequences of Insider Transactions [Die Auswirkungen von Corporate Governance auf die Fremdfinanzierungskosten von Unternehmen - Eine empirische Analyse der Folgen von Aktientransaktionen durch Insider], Gabler, Wiesbaden

Wölbert, E. and Riedl, A. (2013), Measuring Time and Risk Preferences: Reliability, Stability, Domain Specificity, discussion papers, Center of Economic Studies & ifo Institute, Munich

Xiao, J., O'Neill, B. (2016), 'Consumer Financial Education and Financial Capability'; in: *International Journal of Consumer studies* 40, 712-721

Zeisberger, S. (2016), Do People Care About Loss Probabilities?, working paper, Institute for Management Research Radboud University, Nijmengen, October 2016

Appendix

A. Regression Analyses of Chapter 5.2, subdivided by quarter

Table 30: Logit regression analyses with a dummy indicating investment in risky assets as dependent variable, by quarter of interview

	Fourth quarter 2010				First quarter 2011				Second quarter 2011			
	CPCM (model 3a)		BPT (model 3b)		CPCM (model 3a)		BPT (model 3b)		CPCM (model 3a)		BPT (model 3b)	
$lnTWealth_h$		.391*** (.138)				.566*** (.133)				.384*** (.080)		
$lnValueSP_h$				.857*** (.148)				.896*** (.134)				.945*** (.105)
$Graduation_{FKP,h}$	.316* (.166)	.241 (.171)	.308* (.166)	.073 (.184)	.250 (.147)	.279 (.156)	.200 (.145)	.179 (.161)	.264** (.112)	.284** (.115)	.310*** (.112)	.291** (.125)
$ProfessionalQual_{FKP,h}$	-.045 (.130)	.005 (.134)	.013 (.130)	.098 (.142)	.158 (.119)	.196 (.129)	.152 (.117)	.133 (.129)	-.029 (.090)	-.043 (.092)	-.043 (.089)	-.136 (.099)
$AllFinLit_h$	.210 (.323)	.142 (.337)	-.001 (.329)	-.086 (.359)	.143 (.295)	.265 (.306)	.164 (.295)	.333 (.324)	.564*** (.203)	.665*** (.221)	.582*** (.202)	.757*** (.224)
Further households-specific characteristics ξ_h	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
β_0	-15.08*** (2.779)	-17.05*** (2.988)	-14.04*** (2.779)	-18.36*** (3.210)	-10.58*** (2.593)	-10.10*** (2.691)	-9.97*** (2.561)	-12.42*** (2.833)	-13.95*** (2.083)	-14.66*** (2.126)	-12.53*** (2.046)	-16.03*** (2.309)
2-Log-Likelihood	342	322	339	296	401	368	408	350	681	650	703	595
Nagelkerkes R^2	.349	.382	.378	.495	.358	.423	.355	.492	.349	.384	.317	.477
Percentage of correctly estimated non-risky investors	64.8	59.0	66.9	72.8	64.3	71.1	66.5	78.4	69.7	69.0	74.6	78.3
Percentage of correctly estimated risky investors	83.2	86.1	80.9	83.5	78.9	81.5	77.4	80.2	73.9	74.8	66.8	74.7
Percentage correct estimates	76.1	75.9	75.2	79.1	72.9	77.3	72.7	79.4	71.9	72.1	70.8	76.5
N	330	330	330	330	384	384	384	384	631	631	631	631

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), 2-Log-Likelihood statistics, Nagelkerkes R^2, and the percentage of correct estimates for the logit regression analyses using equations (3a) and (3b). ξ_h captures age (Age_h), squared age ($Age^2{}_h$), and gender ($Female_h$) of household's FKP, the monthly household income ($Income_h$), households' directly queried risk attitude ($RiskAtt_h$), and a dummy variable that indicates whether at least one child at the age of 16 or younger lives in the household ($Child_h$). $ProfessionalQual_h$ captures the professional qualification of the FKP in household h and $AllFinLit_h$ indicates whether household h answered all three financial literacy questions correct. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing the risky asset dummy on equation (3b) on households that were interviewed in the fourth quarter of 2010 with $ValueSP_h$ as wealth measure yields a coefficient of $ValueSP_h$ of .857 with a statistical significance at the one-percent level and a Nagelkerkes R^2 of .495.

Table 31: Stepwise regression analyses with $PercentageRisky_{h,TW}$ (specification a), $PercentageRisky_{h,SP}$ (specification b), $\sigma_{h,3years}$ (specification c), and $\sigma_{h,4years}$ (specification d) as dependent variable ω_h, by quarter of interview

Panel A: Fourth quarter 2010

Framework	CPCM (model 3a)		BPT (model 3b)					
Dependent variable $\omega_h/\omega_{h,l}$	$PercentageRisky_{h,CPCM}$		$PercentageRisky_{h,SP}$		$\sigma_{h,3years}$		$\sigma_{h,4years}$	
$lnTWealth_h$		.287** (.143)						
$lnValueSP_h$				.845*** (.139)		.586*** (.105)		.581*** (.104)
$Graduation_{FKP,h}$	.265** (.179)	.216 (.180)	.444** (.204)	.212 (.197)	.292* (.152)	.131 (.149)	.290* (.151)	.130 (.147)
$ProfessionalQual_{FKP,h}$	.073 (.138)	.103 (.138)	.088 (.157)	.125 (.149)	.080 (.117)	.106 (.112)	.078 (.116)	.104 (.111)
$AllFinLit_h$	.268 (.361)	.184 (.362)	.077 (.412)	-.025 (.391)	.040 (.308)	-.030 (.295)	.040 (.306)	-.031 (.293)
Further households-specific characteristics ξ_h	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
β_0	-20.44*** (2.640)	-18.02*** (2.536)	-19.98*** (3.011)	-21.09*** (2.862)	-16.86*** (2.254)	-17.63*** (2.159)	-16.79*** (2.234)	-17.55*** (2.141)
R^2	.282	.296	.292	.365	.297	.360	.298	.360
R^2 adj.	.259	.271	.269	.343	.275	.338	.276	.338
F-Test	12.52	11.90	13.13	16.60	13.51	16.25	13.51	16.25
N	330	330	330	330	330	330	330	330

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R^2, adjusted R^2 (R^2 adj.), and F-statistics (F-Test) for the linear regression analyses using equations (3a) and (3b). Further households-specific characteristics ξ_h captures age (Age_h), squared age ($Age^2{}_h$), and gender ($Female_h$) of household's FKP, the monthly household income ($Income_h$), households' directly queried risk attitude ($RiskAtt_h$), and a dummy variable that indicates whether at least one child at the age of 16 or younger lives in the household ($Child_h$). $ProfessionalQual_h$ captures the professional qualification of the FKP in household h and $AllFinLit_h$ indicates whether household h answered all three financial literacy questions correct. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing $PercentageRisky_{h,SP}$ on equation (3b) with $ValueSP_h$ as wealth measure yields a coefficient of $ValueSP_h$ of .845 with a statistical significance at the one-percent level and an adjusted R^2 of .343.

Table 31: Stepwise regression analyses with $PercentageRisky_{h,TW}$ (specification a), $PercentageRisky_{h,SP}$ (specification b), $\sigma_{h,3years}$ (specification c), and $\sigma_{h,4years}$ (specification d) as dependent variable ω_h, by quarter of interview (cont'd)

Panel B: First quarter 2011

Framework	CPCM (model 3a)		BPT (model 3b)					
Dependent variable $\omega_h/\omega_{h,l}$	$PercentageRisky_{h,CPCM}$		$PercentageRisky_{h,SP}$		$\sigma_{h,3years}$		$\sigma_{h,4years}$	
$lnTWealth_h$		.257** (.126)						
$lnValueSP_h$				.896*** (.126)		.615*** (.095)		.613*** (.094)
$Graduation_{FKP,h}$	.151 (.159)	.159 (.159)	.286 (.188)	.244 (.177)	.216 (.140)	.188 (.133)	.217 (.139)	.188 (.132)
$ProfessionalQual_{FKP,h}$	.222* (.125)	.221* (.125)	.179 (.148)	.116 (.139)	.130 (.110)	.087 (.105)	.129 (.109)	.086 (.104)
$AllFinLit_h$	.478 (.318)	.558* (.315)	.327 (.377)	.487 (.355)	.250 (.281)	.360 (.267)	.247 (.279)	.357 (.266)
Further households-specific characteristics ξ_h	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
β_0	-15.72*** (2.407)	-15.68*** (2.481)	-17.28*** (2.967)	-17.59*** (2.787)	-14.52*** (2.208)	-14.73*** (2.096)	-14.49*** (2.198)	-14.70*** (2.085)
R^2	.310	.329	.289	.374	.284	.357	.285	.358
R^2 adj.	.291	.309	.270	.356	.265	.338	.265	.339
F-Test	16.74	16.33	15.16	20.22	14.81	18.80	14.84	18.84
N	384	384	384	384	384	384	384	384

Table 31: Stepwise regression analyses with $PercentageRisky_{h,TW}$ (specification a), $PercentageRisky_{h,SP}$ (specification b), $\sigma_{h,3years}$ (specification c), and $\sigma_{h,4years}$ (specification d) as dependent variable ω_h, by quarter of interview (cont'd)

Panel C: Second quarter 2011

Framework	CPCM (model 3a)		BPT (model 3b)					
Dependent variable $\omega_h/\omega_{h,l}$	$PercentageRisky_{h,CPCM}$		$PercentageRisky_{h,BPT}$		$\sigma_{h,3years}$		$\sigma_{h,4years}$	
$lnTWealth_h$		.182** (.083)						
$lnValueSP_h$				1.006*** (.097)		.691*** (.072)		.693*** (.072)
$Graduation_{FKP,h}$	.312** (.128)	.316** (.129)	.498*** (.149)	.413*** (.138)	.363*** (.110)	.305*** (.103)	.362*** (.110)	.304*** (.103)
$ProfessionalQual_{FKP,h}$	.015 (.100)	.007 (.100)	-.061 (.116)	-.155 (.108)	-.046 (.086)	-.110 (.081)	-.045 (.086)	-.109 (.080)
$AllFinLit_h$	.777*** (.231)	.806*** (.233)	.879*** (.269)	.950*** (.248)	.665*** (.199)	.713*** (.186)	.662*** (.198)	.711*** (.185)
Further households-specific characteristics ξ_h	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
β_0	-19.26*** (2.116)	-17.01*** (2.066)	-20.76*** (2.467)	-22.02*** (2.282)	-17.52*** (1.823)	-18.38*** (1.706)	-17.52*** (1.822)	-18.38*** (1.704)
R^2	.276	.279	.257	.367	.260	.355	.261	.356
R^2 adj.	.265	.266	.245	.356	.249	.344	.249	.345
F-Test	23.68	21.56	21.45	32.66	21.84	31.02	21.87	31.12
N	631	631	631	631	631	631	631	631

B. The exclusion of households which invest more than 90 percent of their portfolios' net value in the asset classes *money market* and *other assets*

After excluding leveraged portfolios and those which undercut a net value of 1,000, EUR the sample size shrinks from 3,565 to 1,845 households. The percentages of the remaining households' portfolios that are invested in the asset classes *money market* and *other assets* are presented in Figure 7.

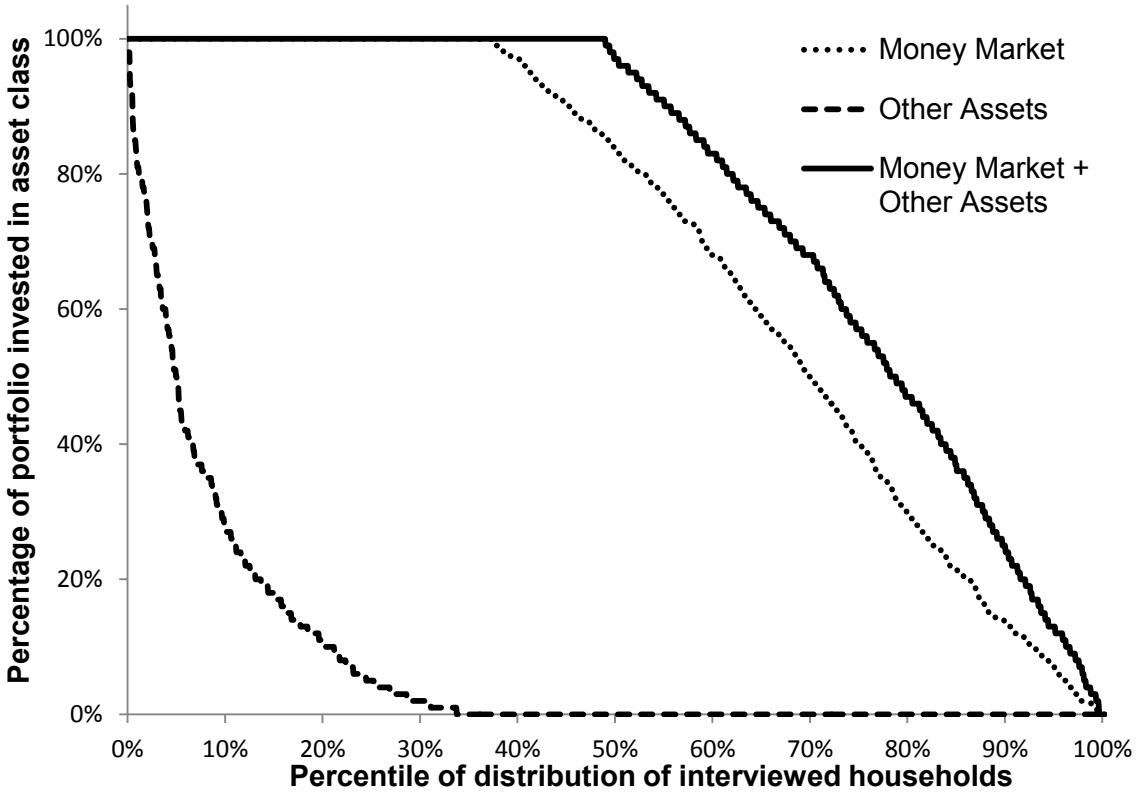

Figure 7: Amounts of households' portfolios invested in money market and other assets

Nearly 40 percent of these remaining households invest their entire speculation-portfolio's net value in the asset class *money market*. These households' portfolios are per definition on the efficient frontier, since the asset class m*oney market* represents an investment in the risk-free asset. Therefore, these households are excluded to not skew the results. Roughly 10 percent of the 1,845 households invest more than 30 percent of their portfolios' net value in the asset class o*ther assets.*

Since the various different assets and purposes associated with this asset class do not allow an appropriate analysis the asset class o*ther assets* is precluded from the calculations of the portfolio outcomes. Given the remaining asset classes' amounts are being normalized in total to 100 percent, the amount invested in the asset class *money market* would be normalized to 100 percent, if households invested solely in the two asset classes o*ther assets* and m*oney market*. This, again, would lead to the above described effect that these households' portfolios would be on the efficient frontier. As a consequence, the households that solely invest in the two asset classes o*ther assets* and *money market* are also excluded. The described exclusions reduce the sample size to 948 households.

Calvet, Campbell, and Sodini (2007) observe that "[r]ich and educated households select portfolios with a high Sharpe-Ratio but also a high risky share, resulting in a high complete return loss. Conversely, unsophisticated households allocate a small fraction of their financial wealth to an inefficient risk portfolio and overall incur low complete portfolio return losses." (Calvet, Campbell, and Sodini 2007, p. 738) To prevent this effect, the 118 households that invest less than 10 percent of the net value of their speculation-portfolio in risky assets are also removed from the sample. The descriptive statistics of the removed speculation-portfolios' net value are presented in Table 32. In addition, the respective statistics of the portfolios that would have been removed, if all portfolios that invested less than 5 or less than 15 percent of the speculation-portfolio's net values in risky assets had been excluded, are provided. The 20^{th} and 80^{th} percentile and the median of the speculation-portfolios' net values of the three samples are very similar to the net value of the 830 portfolios that are used for further analyses. Hence, the 118 excluded households are not less wealthy than the remaining households (and would, therefore, be able to invest in risky assets) but are just not interested in investing their wealth in risky assets. In addition, the decision to set the minimal amount of risky assets to 10 percent is unlikely to harm the generalizability of the results since setting the minimal amount to 5 or 15 percent would not change the structure regarding the speculation-portfolios' net values in the sample.

Table 32: Descriptive statistics of the net value of the speculation-portfolios which show a high amount of investments in the asset classes money market and other assets

	Percentage of portfolio invested in asset classes *Money market* and *Other assets*		
	>95	>90	>85
Mean	147,850	126,966	121,170
20th percentile	35,630	33,380	34,100
Median	80,600	73,000	73,000
80th percentile	195,480	197,176	186,008
Std.	176,309	147,093	151,358
N	55	118	187

C. Households' ability and purpose to save (subsample of 830 households with unlevered speculation portfolios)

The following tables provide descriptive statistics on households' assessment whether their income is appropriate to cover their needs ($ApprIncome_h$, see Table 33), and household's estimation whether they will be able to save in the next year ($FutSavings_h$, see Table 34). As presented in Table 33, only .5 percent of the households state that their monthly income covers their expenses "with great difficulties". In contrast, 93.3 percent of the households state that their monthly income (fairly) easily captures their expenses. The latter finding supports the assumption that the chosen approach is adequate to extract those households which are able to establish a speculation-portfolio.

Table 33: Households' assessment whether their monthly income is sufficient to capture expenses ($ApprIncome_h$)

	N	Percentage
with great difficulty	4	0.5
with some difficulties	52	6.3
fairly easily	281	33.9
easily	493	59.4
Σ	830	100

Table 34: Households' estimation regarding future savings ($FutSavings_h$)

	N	Percentage
Question filtered, do not know	36	4.3
A smaller share	164	19.8
The same share	543	65.4
A larger share	87	10.5
Σ	830	100

Descriptive statistics of households' main purpose for saving are presented in Table 35. More than 60 percent of the households primarily save for old-age provisions and emergency situation. Combined with the 3rd and 4th popular purposes ("large purchase excl. vehicles" and "training/supporting children or grandchildren") the ANOVA analysis covers roughly 80 percent of households saving purposes.

Table 35: Households' main purpose for saving

	N	Percentage
old-age provision	269	32.4
funds for emergency situations	246	29.6
larger purchase excl. vehicles (second property, furniture, etc.)	74	8.9
training / supporting children or grandchildren	61	7.3
holiday / travel	39	4.7
other	141	17.0
Σ	830	100

D. Stepwise approach regarding the wealth measures in the regression analyses of chapter 6.2.2

Stepwise regression analyses are used to check whether the value of households' speculation-portfolios shows more explanatory power regarding households' investment outcomes than the wealth measures of former studies (households' total wealth and monthly income). The analyses show that households' total wealth and monthly income are not statistically significant when the value of households' speculation-portfolios is included as independent variable to explain the return loss ($RL_{h,T}$, see Table 36 and Table 37), the unnecessary volatility ($UV_{h,T}$, see Table 38 and Table 39), and the Sharpe-Ratio ($SR_{h,T}$, see Table 40 and Table 41) of households' portfolios. Hence, the value of households' speculation-portfolio is a more appropriate proxy to control for the influence of households' wealth on the efficiency of households' speculation-portfolios.

Table 36: Influence of the value of households' speculation-portfolio and households' monthly income on the return loss of households' speculation-portfolios

Estimation period of $RL_{h,T}$	0.5 yr	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	.005* (.003)	.005** (.002)	.002 (.001)	.001* (.001)	.001 (.001)
$Income_h$	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
β_0	.037 (.029)	.002 (.020)	.031** (.013)	.013* (.007)	.021*** (.007)
R²	.004	.011	.002	.004	.001
R² adj.	.002	.009	.000	.001	-.001
F-Test	1.641	4.580	.994	1.471	.605

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R², adjusted R^2 (R² adj.), and F-statistics (F-Test) for the regression analysis using the logarithmized value of the respective household's speculation-portfolio ($lnValueSP_h$) and the household's monthly income in Euros ($Income_h$) as independent variable with the return loss of households' speculation-portfolios per estimation period ($RL_{h,T}$) as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing the return loss of households' speculation-portfolios of the year after the survey had taken place on $lnValueSP_h$ and $Income_h$ yields a coefficient of the net value of the speculation-portfolio of .005 with a statistical significance at the five-percent level and an adjusted R² of .009.

Table 37: Influence of the value of households' speculation-portfolio and households' total wealth on the return loss of households' speculation-portfolios

Estimation period of $RL_{h,T}$	0.5 yr	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	.005 (.003)	.006*** (.002)	.002 (.001)	.001 (.001)	.001 (.001)
$lnTWealth_h$	-.002 (.003)	.000 (.002)	.000 (.001)	.000 (.001)	.000 (.001)
β_0	.052 (.034)	.003 (.023)	.033** (.015)	.012 (.008)	.019** (.008)
R²	.003	.012	.003	.004	.002
R² adj.	.001	.010	.001	.002	.000
F-Test	1.397	5.039	1.233	1.773	.861

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R², adjusted R^2 (R² adj.), and F-statistics (F-Test) for the regression analysis using the logarithmized value of the respective household's speculation-portfolio ($lnValueSP_h$) and the household's logarithmized total wealth in EUR ($lnTWealth_h$) as independent variable with the return loss of households' speculation-portfolios per estimation period ($RL_{h,T}$) as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing the return loss of households' speculation-portfolios of the year after the survey had taken place on $lnValueSP_h$ and $TWealth_h$ yields a coefficient of the value of the speculation-portfolio of .006 with a statistical significance at the one-percent level and an adjusted R² of .010.

Table 38: Influence of the value of households' speculation-portfolio and households' monthly income on the unnecessary volatility of households' speculation-portfolios

Estimation period of $UV_{h,T}$	0.5 yr	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	-.005** (.002)	.007*** (.002)	.003 (.002)	.002 (.001)	.001 (.001)
$Income_h$	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
β_0	.134*** (.025)	.004 (.023)	.031* (.018)	.016 (.010)	.019* (.010)
R²	.006	.013	.003	.003	.002
R² adj.	.004	.011	.001	.001	.000
F-Test	2.607	5.557	1.288	1.346	1.014

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R², adjusted R^2 (R² adj.), and F-statistics (F-Test) for the regression analysis using the logarithmized value of the respective household's speculation-portfolio ($lnValueSP_h$) and the household's monthly income in Euros ($Income_h$) as independent variable with the unnecessary volatility of households' speculation-portfolios per estimation period ($UV_{h,T}$) as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing the unnecessary volatility of households' speculation-portfolios of the year after the survey had taken place on $lnValueSP_h$ and $Income_h$yields a coefficient of the value of the speculation-portfolio of .007 with a statistical significance at the one-percent level and an adjusted R² of .011.

Table 39: Influence of the value of households' speculation-portfolio and households' total wealth on the unnecessary volatility of households' speculation-portfolios

Estimation period of $UV_{h,T}$	0.5 yr	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	-.003 (.003)	.008*** (.002)	.003* (.002)	.002 (.001)	.002 (.001)
$lnTWealth_h$	-.004 (.003)	-.001 (.002)	-,001 (.002)	.000 (.001)	.000 (.001)
β_0	.160*** (.029)	.010 (.027)	.032 (.021)	.017 (.012)	.017 (.012)
R²	.009	.015	.004	.003	.003
R² adj.	.007	.013	.002	.001	.001
F-Test	3.807	6.247	1.688	1.422	1.294

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R adjusted R^2 (R² adj.), and F-statistics (F-Test) for the regression analysis using the logarithmized value of the respective household's speculation-portfolio ($lnValueSP_h$) and the household's logarithmized total wealth in EUR ($lnTWealth_h$) as independent variable with the unnecessary volatility of households' speculation-portfolios per estimation period ($UV_{h,T}$) as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing the unnecessary volatility of households' speculation-portfolios of the year before the survey had taken place on $lnValueSP_h$ and $lnTWealth_h$yields a coefficient of the value of the speculation-portfolio of .008 with a statistical significance at the one-percent level and an adjusted R² of .013.

Table 40: Influence of the value of households' speculation-portfolio and households' monthly income on the Sharpe-Ratio of households' speculation-portfolios

Estimation period of $SR_{h,T}$	0.5 yr	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	-.033 (.030)	-.036*** (.013)	-.005 (.009)	-.002 (.005)	.005 (.007)
$Income_h$	.000 (.000)	-.000 (.000)	-.000 (.000)	.000 (.000)	-.000 (.000)
β_0	-.163 (.330)	.236* (.139)	.470*** (.103)	.545*** (.057)	.629*** (.073)
R²	.002	.012	.002	.000	.001
R² adj.	-.001	.010	-.001	-.002	-.002
F-Test	.638	5.155	.645	.206	.356

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R², adjusted R^2 (R² adj.), and F-statistics (F-Test) for the regression analysis using the logarithmized value of the respective household's speculation-portfolio ($lnValueSP_h$) and the household's monthly income in Euros ($Income_h$) as independent variable with the Sharpe-Ratio of households' speculation-portfolios per estimation period ($SR_{h,T}$) as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing the Sharpe-Ratio of households' speculation-portfolios of the year after the survey had taken place on $lnValueSP_h$ and $Income_h$ yields a coefficient of the value of the speculation-portfolio of -.036 with a statistical significance at the one-percent level and an adjusted R² of .010.

Table 41: Influence of the value of households' speculation-portfolio and households' total wealth on the Sharpe-Ratio of households' speculation-portfolios

Estimation period of $SR_{h,T}$	0.5 yr	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	-.011 (.035)	-.039*** (.015)	-.008 (.011)	-.001 (.006)	-.003 (.008)
$lnTWealth_h$	-.027 (.034)	.000 (.014)	-.001 (.011)	-.002 (.006)	.000 (.008)
β_0	-.051 (.382)	.264 (.161)	.506*** (.119)	.560*** (.066)	.649*** (.085)
R²	.002	.013	.001	.000	.000
R² adj.	-.001	.010	-.001	-.002	-.002
F-Test	.773	5.240	.427	.145	.085

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R², adjusted R^2 (R² adj.), and F-statistics (F-Test) for the regression analysis using the logarithmized value of the respective household's speculation-portfolio ($lnValueSP_h$) and the household's logarithmized total wealth in EUR ($lnTWealth_h$) as independent variable with the Sharpe-Ratio of households' speculation-portfolios per estimation period ($SR_{h,T}$) as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing the Sharpe-Ratio of households' speculation-portfolios of the year after the survey had taken place on $lnValueSP_h$ and $lnTWealth_h$ yields a coefficient of the value of the speculation-portfolio of -.039 with a statistical significance at the one-percent level and an adjusted R² of .010.

E. Correlation coefficients (Pearson) between the value of households' speculation-portfolios and the return, standard deviation of returns, return loss, unnecessary volatility, and Sharpe-Ratio of the speculation-portfolio subdivided by quarters

Table 42: Correlation coefficients (Pearson) between the value of households' speculation-portfolios and the return, standard deviation of returns, return loss, unnecessary volatility, and Sharpe-Ratio of the speculation-portfolio

Panel A: Fourth quarter 2010, 226 portfolios

Estimation period T	$\mu_{h,T}$	$\sigma_{h,T}$	$RL_{h,T}$	$UV_{h,T}$	$SR_{h,T}$
3 months	-,011	,030	,017	,168**	-,027
6 months	-,006	,038	,111*	,203***	-,014
9 months	-,140**	,028	,121*	,110*	-,117*
12 months	-,148**	,041	,126*	,111*	-,097
2 years	-,063	,047	,092	,090	-,077
3 years	,006	,046	,080	,082	-,036
4 years	,003	,046	,070	,074	-,041

Panel B: First quarter 2011, 253 portfolios

Estimation period T	$\mu_{h,T}$	$\sigma_{h,T}$	$RL_{h,T}$	$UV_{h,T}$	$SR_{h,T}$
3 months	,144**	,027	-,074	,024	,095
6 months	-,098	,005	,098	,004	-,111*
9 months	-,120*	,024	,124**	,024	-,148**
12 months	-,132**	,030	,112*	,080	-,109*
2 years	-,101	,029	,109*	,90	-,088
3 years	-,018	,028	,082	,074	-,043
4 years	-,021	,030	,086	,081	-,046

Panel C: Second quarter 2011, 351 portfolios

Estimation period T	$\mu_{h,T}$	$\sigma_{h,T}$	$RL_{h,T}$	$UV_{h,T}$	$SR_{h,T}$
3 months	-,128**	,068	,128**	,070	-,067
6 months	-,131**	,079	,131**	,079	-,076
9 months	-,068	,084	,098	,148***	-,061
12 months	-,069	,084	,093	,152***	-,053
2 years	,059	,082	,061	,069	-,004
3 years	,069	,084	,054	,078	-,004
4 years	,092	,085	,041	,055	,019

Notes: The table provides Pearson correlation coefficients between the value of households' speculation-portfolio and the return $\mu_{h,T}$, standard deviation of returns $\sigma_{h,T}$, return loss $RL_{h,T}$, unnecessary volatility $UV_{h,T}$ (both as deviation from the efficient frontier of the respective estimation period), and Sharpe-Ratio $SR_{h,T}$. The sample is subdivided according to the point in time when the households were interviewed. Panel A includes households which were interviewed in the 4th quarter 2010; Panel B (C) includes households which were interviewed in the 1st quarter 2011 (2nd quarter 2011). The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: For the households that were interviewed in the fourth quarter of the year 2010 and for the estimation period which started one day and ends 3 months after the households had been interviewed, the Pearson correlation coefficient between the value of households' speculation-portfolios and the return loss of households' portfolios is .017 with no statistical significance.

F. Regression analyses of Section 6.2.2 regarding the influence of household wealth on the speculation-portfolio's efficiency subdivided by quarters

Table 43: Influence of households' characteristics on the return loss of households' speculation-portfolios

Panel A: Fourth quarter 2010, 226 portfolios					
Estimation period of $RL_{h,T}$	0.5 yrs	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	.000 (.006)	.000 (.003)	-.001 (.002)	.000 (.001)	-.001 (.001)
$Female_h$	-.026** (.013)	-.012* (.006)	-.010** (.005)	-.004* (.002)	-.005* (.003)
Age_h	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)
$Income_h$	-.000 (000)	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
$lnTWealth_h$	-.001 (006)	.001 (.003)	.001 (.002)	.001 (.001)	.001 (.001)
$RiskAtt_h$	.058*** (.012)	.030*** (.006)	.024*** (.004)	.010*** (002)	.014*** (.003)
$ApprIncome_h$	*-.001 (.010)	.002 (.005)	.001 (.004)	.001 (.002)	.000 (.002)
$FutSavings_h$	.019** (.009)	.010** (.004)	.007** (.003)	.003* (.002)	.004** (.002)
β_0	.025 (.083)	-.031 (.040)	-.007 (.031)	-.002 (.015)	.002 (.018)
R²	.138	.156	.160	.123	.158
R² adj.	.110	.128	.132	.094	.130
F-Test	4.849	5.594	5.763	4.238	5.681

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R², adjusted R^2 (R² adj.), and F-statistics (F-Test) for the regression analysis using equation (6) with the return loss of households' speculation-portfolio per estimation period as dependent variable. The sample is subdivided according to the point in time when the households were interviewed. Panel A includes households which were interviewed in the 4th quarter 2010; Panel B (C) includes households which were interviewed in the 1st quarter 2011 (2nd quarter 2011). The symbols ***, **, and * denote statistical significance at one-, five-, and ten-percent level, respectively. Example: For the subsamples of households that were interviewed in the fourth quarter of the year 2010, regressing the return loss of households' speculation-portfolios of the year after the survey had taken place on the model of equation (6) yields a coefficient of the value of the speculation-portfolio of .000 with no statistical significance and an adjusted R² of .128.

Table 43: Influence of households' characteristics on the return loss of households' speculation-portfolios (cont'd)

Panel B: First quarter 2011, 253 portfolios					
Estimation period of $RL_{h,T}$	0.5 yrs	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	.006 (.005)	.003 (.004)	.000 (.002)	.000 (.001)	.000 (.001)
$Female_h$	-.024** (.010)	-.023*** (.008)	-.015*** (.005)	-.006*** (.002)	-.007*** (.002)
Age_h	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)
$Income_h$	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)	.000 (.000)
$lnTWealth_h$	.000 (.005)	.000 (.004)	-.001 (.002)	.000 (.001)	.000 (.001)
$RiskAtt_h$	.064*** (.008)	.049*** (.007)	.027*** (.004)	.013*** (.002)	.013*** (.002)
$ApprIncome_h$	-.010 (.008)	-.009 (.006)	-.006* (.004)	-.002 (.002)	-.003* (.002)
$FutSavings_h$	.003 (.007)	.004 (.006)	.002 (.003)	.001 (.002)	.001 (.002)
β_0	.002 (.061)	.019 (.048)	.067** (.029)	.023* (.014)	.036 (.014)
R^2	.190	.186	.168	.165	.170
R^2 adj.	.172	.167	.149	.146	.151
F-Test	10.060	9.744	8.653	8.465	8.779

Table 43: Influence of households' characteristics on the return loss of households' speculation-portfolios (cont'd)

Panel C: Second quarter 2011, 351 portfolios					
Estimation period of $RL_{h,T}$	0.5 yrs	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	.001 (.001)	.008** (.004)	.004 (.003)	.002 (.002)	.002 (.002)
$Female_h$	.001 (.003)	.009 (.008)	.004 (.005)	.003 (.003)	.003 (.004)
Age_h	.000 (.000)	-.001* (.000)	-.000** (.000)	.000* (.000)	-.000** (.000)
$Income_h$	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)
$lnTWealth_h$	.000 (.001)	.006* (.004)	.004* (.002)	.002 (.001)	.003* (.002)
$RiskAtt_h$	-.001 (.002)	.025*** (.007)	.016*** (.005)	.008*** (.003)	.010*** (.003)
$ApprIncome_h$	-.001 (.002)	-.003 (.006)	-.001 (.004)	-.002 (.002)	-.001 (.003)
$FutSavings_h$	.000 (.002)	-.007 (.006)	-.002 (.004)	-.003 (.002)	-.002 (.003)
β_0	.007 (.017)	-.105** (.050)	-.051 (.032)	-.021 (.020)	-.025 (.022)
R^2	.023	.126	.122	.094	.105
R^2 adj.	-.013	.094	.089	.060	.072
F-Test	.638	3.886	3.740	2.781	3.164

Table 44: Influence of households' characteristics on the unnecessary volatility of households' speculation-portfolios

Panel A: Fourth quarter 2010, 226 portfolios					
Estimation period of $UV_{h,T}$:	0.5 yr	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	-.004 (.004)	-.001 (.005)	-.002 (.004)	-.001 (.002)	-.002 (.002)
$Female_h$	-.013 (.009)	-.017* (.010)	-.017** (.008)	-.009** (.004)	-.010** (.005)
Age_h	.001* (.000)	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)
$Income_h$	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
$lnTWealth_h$	-.005 (.004)	-.001 (.005)	.001 (.004)	.001 (.002)	.001 (.002)
$RiskAtt_h$	.019** (.008)	.042*** (.009)	.034*** (.007)	.018*** (.004)	.020*** (.004)
$ApprIncome_h$	-.004 (.007)	.000 (.007)	.001 (.006)	.002 (.003)	.001 (.004)
$FutSavings_h$	.009 (.006)	.013* (.007)	.011** (.005)	.005* (.003)	.006* (.003)
β_0	.155 (.056)	.024 (.063)	.004 (.052)	-.002 (.028)	.000 (.030)
R^2	.062	.119	.128	.119	.131
R^2 adj.	.031	.090	.099	.089	.102
F-Test	1.997	4.104	4.422	4.069	4.541

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R adjusted R^2 (R^2 adj.), and F-statistics (F-Test) for the regression analysis using equation (7) with the unnecessary volatility of households' speculation-portfolio per estimation period as dependent variable. The sample is subdivided according to the point in time when the households were interviewed. Panel A includes households which were interviewed in the 4th quarter 2010; Panel B (C) includes households which were interviewed in the 1st quarter 2011 (2nd quarter 2011). The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: For the subsamples of households that were interviewed in the fourth quarter of the year 2010, regressing the unnecessary volatility of households' speculation-portfolios of the year after the survey had taken place on the model of equation (7) yields a coefficient of the value of the speculation-portfolio of -.001 with no statistical significance and an adjusted R^2 of .090.

Table 44: Influence of households' characteristics on the unnecessary volatility of households' speculation-portfolios (cont'd)

Panel B: First quarter 2011, 253 portfolios					
Estimation period of $UV_{h,T}$:	0.5 yrs	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	-.006 (.005)	.004 (.004)	-.001 (.003)	.000 (.002)	.000 (.002)
$Female_h$	-.004 (.009)	-.018** (.007)	-.013** (.005)	-.009** (.004)	-.008*** (.003)
Age_h	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)
$Income_h$	.000 (000)	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
$lnTWealth_h$	-.006 (.004)	.000 (.003)	-.002 (.002)	.000 (002)	-.001 (.001)
$RiskAtt_h$	.031*** (.008)	.047*** (.006)	.029*** (.004)	.022*** (.003)	.018*** (.003)
$ApprIncome_h$	-.009 (.007)	-.008 (.006)	-.007* (.004)	-.004 (.003)	-.004* (.002)
$FutSavings_h$	.004 (.007)	.004 (.005)	.003 (.004)	.001 (003)	.001 (.002)
β_0	.208*** (.059)	-.005 (.047)	.072** (.033)	.026 (.023)	.036* (.019)
R^2	.058	.175	.142	.157	.157
R^2 adj.	.036	.156	.122	.137	.137
F-Test	2.626	9.085	7.090	7.940	7.937

Table 44: Influence of households' characteristics on the unnecessary volatility of households' speculation-portfolios (cont'd)

Panel C: Second quarter 2011, 351 portfolios					
Estimation period of $UV_{h,T}$:	0.5 yrs	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	.001**	.012**	.006	.003	.003
	(.001)	(.005)	(.004)	(.002)	(.002)
$Female_h$	.001	.009	.009	.005	.005
	(.001)	(.010)	(.009)	(.004)	(.005)
Age_h	.000	-.001**	-.001**	.000*	.000***
	(.000)	(.000)	(.000)	(.000)	(.000)
$Income_h$	.000	-.000	-.000	-.000	-.000
	(.000)	(.000)	(.000)	(.000)	(.000)
$lnTWealth_h$	.000	.005	.007*	.003	.004*
	(.001)	(.004)	(.004)	(.002)	(.002)
$RiskAtt_h$	.001	.033***	.027***	.011***	.015***
	(.001)	(.009)	(.008)	(.004)	(.004)
$ApprIncome_h$	-.001	-.006	-.001	-.003	-.002
	(.001)	(.008)	(.007)	(.003)	(.004)
$FutSavings_h$	.000	-.009	-.004	-.004	-.003
	(.001)	(.008)	(.007)	(.003)	(.004)
β_0	-.005	-.101	-.095*	-.029	-.044
	(.008)	(.062)	(.053)	(.025)	(.031)
R^2	.057	.138	.113	.094	.103
R^2 adj.	.022	.106	.080	.060	.070
F-Test	1.614	4.315	3.435	2.781	3.098

Table 45: Influence of households' characteristics on the Sharpe-Ratio of households' speculation-portfolios

Panel A: Fourth quarter 2010, 226 portfolios					
Estimation period of $SR_{h,T}$:	0.5 yr	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	-.020 (.045)	-.003 (.020)	.011 (.019)	.001 (.010)	.021 (.017)
$Female_h$	.059 (.094)	.046 (.041)	.043 (.039)	.052** (.022)	.052 (.035)
Age_h	.004 (.003)	.002 (.001)	.002 (.001)	.002** (.001)	.002 (.001)
$Income_h$	-.000 (.000)	-.000 (.000)	-.000 (.000)	.000 (.000)	.000 (.000)
$lnTWealth_h$	-.031 (.044)	-.014 (.019)	-.010 (.018)	-.012 (.010)	-.010 (016)
$RiskAtt_h$	-.403*** (.085)	-.167*** (.037)	-.148*** (.036)	-.045** (.020)	-.110*** (.032)
$ApprIncome_h$	.058 (.071)	.013 (.031)	.001 (.030)	.001 (.016)	.001 (.026)
$FutSavings_h$	-.135** (.064)	-.056** (.028)	-.053 (.027)	-.020 (.015)	-.049** (.024)
β_0	-.068 (.603)	.297 (.262)	.517** (.252)	.544*** (.140)	.726*** (.225)
R²	.164	.160	.133	.099	.114
R² adj.	.136	.132	.104	.069	.085
F-Test	5.915	5.746	4.625	3.314	3.897

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R², adjusted R^2 (R² adj.), and F-statistics (F-Test) for the regression analysis using equation (8) with the Sharpe-Ratio of households' speculation-portfolios per estimation period as dependent variable. The sample is subdivided according to the point in time when the households were interviewed. Panel A includes households which were interviewed in the 4th quarter 2010; Panel B (C) includes households which were interviewed in the 1st quarter 2011 (2nd quarter 2011). The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: Regressing the Sharpe-Ratio of households' speculation-portfolios of the year after the survey had taken place on the model of equation (8) yields a coefficient of the value of the speculation-portfolio of -.003 with no statistical significance and an adjusted R² of .132.

Table 45: Influence of households' characteristics on the Sharpe-Ratio of households' speculation-portfolios (cont'd)

Panel B: First quarter 2011, 253 portfolios					
Estimation period of $SR_{h,T}$:	0.5 yr	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	-.087***	-.040*	-.003	.004	.006
	(.028)	(.024)	(.018)	(.009)	(.010)
$Female_h$	.116**	.144***	.127***	.054***	.071***
	(.056)	(.047)	(.035)	(.018)	(.019)
Age_h	.004*	.003	.002	.001	.001
	(.002)	(.002)	(.001)	(.001)	(.001)
$Income_h$	.000**	.000*	.000	.000*	.000
	(.000)	(.000)	(.000)	(.000)	(.000)
$lnTWealth_h$	-.038	-.011	.006	-.003	.001
	(.026)	(.022)	(.016)	(.009)	(.009)
$RiskAtt_h$	-.253***	-.244***	-.156***	-.088***	-.090***
	(.048)	(.041)	(.030)	(.016)	(.017)
$ApprIncome_h$	.043	.065*	.065**	.020	.033**
	(.045)	(.038)	(.028)	(.015)	(.015)
$FutSavings_h$	-.009	-.044	-.033	-.015	-.013
	(.041)	(.034)	(.025)	(.013)	(.014)
β_0	.393	.312	.304	.525***	.541***
	(.354)	(.299)	(.220)	(.116)	(.122)
R^2	.164	.166	.146	.132	.149
R^2 adj.	.145	.146	.126	.112	.129
F-Test	8.408	8.500	7.307	6.514	7.475

Table 45: Influence of households' characteristics on the Sharpe-Ratio of households' speculation-portfolios (cont'd)

Panel C: Second quarter 2011, 351 portfolios					
Estimation period of $SR_{h,T}$:	0.5 yr	1 yr	2 yrs	3 yrs	4 yrs
$lnValueSP_h$	.011 (.064)	-.039 (.033)	-.011 (.017)	-.010 (.014)	-.008 (.013)
$Female_h$	-.055 (.134)	-.022 (.070)	-.026 (.036)	-.020 (.029)	-.019 (.028)
Age_h	-.006 (.005)	.003 (.002)	.004*** (.001)	.002* (.001)	.004*** (.001)
$Income_h$	-.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)
$lnTWealth_h$	.013 (.058)	-.031 (.030)	-.037** (.015)	-.015 (.012)	-.026** (.012)
$RiskAtt_h$	.210* (.117)	-.015 (.061)	-.052* (.031)	.009 (.025)	-.033 (.024)
$ApprIncome_h$	.004 (.101)	.002 (.052)	-.020 (.027)	.012 (.022)	-.004 (.021)
$FutSavings_h$	.057 (.100)	.046 (.052)	.004 (.027)	.029 (.022)	.012 (.021)
β_0	.336 (.811)	.245 (.421)	.809*** (.217)	.591*** (.174)	.808*** (.169)
R^2	.033	.028	.096	.035	.091
R^2 adj.	-.003	-.009	.063	-.001	.058
F-Test	.914	.763	2.863	.979	2.701

G. Analyses of Section 7.2.1 regarding the comparison of portfolio performance resulting from buy-and-hold and rebalancing strategies subdivided by quarters

Table 46: Influence of Rebalancing on Portfolio Efficiency

Panel A: Households surveyed in fourth quarter 2010 (N=226)					
	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Number of portfolios with					
Enhanced efficiency (Delta μ >=0 & Delta σ <0) or (Delta μ >0 & Delta σ =0)	92	93	75	59	33
Decreased efficiency (Delta μ <0 & Delta σ >=0) or (Delta μ =0 & Delta σ >0)	1	8	2	4	8
Ambiguous (else)	133	125	149	163	185
Panel B: Households surveyed in first quarter 2011 (N=253)					
	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Number of portfolios with					
Enhanced efficiency (Delta μ >=0 & Delta σ <0) or (Delta μ >0 & Delta σ =0)	12	63	19	15	7
Decreased efficiency (Delta μ <0 & Delta σ >=0) or (Delta μ =0 & Delta σ >0)	26	27	20	37	34
Ambiguous (else)	215	163	214	201	212
Panel C: Households surveyed in second quarter 2011 (N=351)					
	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Number of portfolios with					
Enhanced efficiency (Delta μ >=0 & Delta σ <0) or (Delta μ >0 & Delta σ =0)	18	137	16	10	9
Decreased efficiency (Delta μ <0 & Delta σ >=0) or (Delta μ =0 & Delta σ >0)	54	9	17	109	85
Ambiguous (else)	279	205	318	232	257

Notes: The table provides the number of portfolios that enhance, decrease or ambiguously change their portfolio efficiency by employing a rebalancing strategy instead of a buy-and-hold strategy. Panel A includes portfolios of households which were interviewed in the 4th quarter 2010; Panel B (C) includes portfolios of households which were interviewed in the 1st quarter 2011 (2nd quarter 2011). Example: Of the 226 households that were interviewed in the 4th quarter 2010, 92 would increase the efficiency of their portfolio by using a monthly rebalancing strategy, one would decrease the efficiency of their portfolio by using a monthly rebalancing strategy and 133 ambiguously change their portfolio efficiency.

H. Comparison of portfolio performance resulting from buy-and-hold and rebalancing strategies of Section 7.2.1 subdivided by quarters

Table 47: Portfolio outcomes of rebalancing strategies compared to buy-and-hold-strategy over a 4 year period

Panel A: Households surveyed in fourth quarter 2010 (N=226)

Annual μ Buy-and-hold strategy		Delta annual μ compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.0543	Mean	.0005***	-.0010***	.0010***	.0003**	-.0001
20%	.029	20%	-.002	-.003	-.002	-.002	-.002
Median	.048	Median	.001	.000	.001	.001	.001
80%	.073	80%	.003	.001	.004	.002	.002
Std.	.029	Std.	.003	.002	.003	.002	.003
Annual σ Buy-and-hold strategy		Delta annual σ compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.0816	Mean	-.0015***	-.0011***	-.0012***	-.0012***	-.0005***
20%	.032	20%	-.004	-.002	-.004	-.004	-.003
Median	.071	Median	.000	.000	.000	.000	.000
80%	.134	80%	.001	.000	.001	.001	.002
Std.	.052	Std.	.003	.002	.003	.003	.002

Notes: The table provides the mean value (Mean), 20-percent percentiles (20%), median value (Median), 80-percent percentiles (80%), and standard deviations (Std.) of the differences of the annual return (μ) and annual standard deviation of returns (σ) between a buy-and-hold strategy and the outcomes of a rebalancing strategy for the same portfolios. Next to the mean values, the table provides the results of parametric t-tests that test whether the mean values differ from 0 at statistically significant levels. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Panel A includes portfolios of households which were interviewed in the 4th quarter 2010; Panel B (C) includes portfolios of households which were interviewed in the 1st quarter 2011 (2nd quarter 2011). Example: The portfolios of households which were interviewed in the 4th quarter 2010 achieve a .05 percent higher mean return with monthly rebalancing strategies than with a buy-and-hold strategy. The higher mean return is different from zero with a statistical significance at the one-percent level.

Table 47: Portfolio outcomes of rebalancing strategies compared to buy-and-hold-strategy over a 4 year period (cont'd)

Panel B: Households surveyed in first quarter 2011 (N=253)

Annual μ Buy-and-hold strategy		Delta annual μ compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.0621	Mean	-.0003*	-.0015***	.0004**	-.0002	-.0004**
20%	.032	20%	-.003	-.004	-.002	-.002	-.003
Median	.056	Median	.000	.000	.001	.000	.000
80%	.090	80%	.002	.000	.003	.002	.002
Std.	.032	Std.	.003	.002	.003	.002	.003
Annual σ Buy-and-hold strategy		Delta annual σ compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.0774	Mean	.0005***	-.0012***	.0009***	.0010***	.0012***
20%	.027	20%	-.002	-.002	-.002	-.002	-.002
Median	.069	Median	.001	-.001	.001	.001	.001
80%	.127	80%	.003	.000	.004	.004	.004
Std.	.053	Std.	.003	.001	.003	.003	.003

Panel C: Households surveyed in second quarter 2011 (N=351)

Annual μ Buy-and-hold strategy		Delta annual μ compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.0685	Mean	-.0014***	-.0018***	-.0006***	-.0014***	-.0014***
20%	.037	20%	-.005	-.005	-.004	-.004	-.005
Median	.064	Median	.000	.000	.000	.000	.000
80%	.095	80%	.001	.000	.002	.001	.001
Std.	.034	Std.	.003	.003	.003	.003	.003
Annual σ Buy-and-hold strategy		Delta annual σ compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.0791	Mean	-.0010***	-.0018***	-.0004**	-.0004*	.0002
20%	.032	20%	-.005	-.004	-.004	-.004	-.003
Median	.069	Median	.000	-.001	.000	.000	.001
80%	.126	80%	.002	.000	.003	.003	.003
Std.	.048	Std.	.003	.002	.003	.003	.003

Table 48: Portfolio outcomes of rebalancing strategies compared to buy-and-hold-strategy over a 4 year period

Panel A: Households surveyed in fourth quarter 2010 (N=226)

Sharpe-Ratio Buy-and-hold strategy		Delta Sharpe-Ratio compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.549	Mean	.028***	-.001	.033***	.023***	.010***
20%	.325	20%	.004	-.017	.009	.004	-.006
Median	.524	Median	.023	.000	.032	.019	.008
80%	.790	80%	.050	.014	.055	.042	.027
Std.	.195	Std.	.028	.022	.024	.023	.022
Adjusted Sharpe-Ratio Buy-and-hold strategy		Delta Adjusted Sharpe-Ratio compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.507	Mean	.019***	-.009***	.020***	.013***	.003
20%	.323	20%	-.004	-.028	-.004	-.003	-.013
Median	.476	Median	.016	.000	.016	.008	.006
80%	.687	80%	.047	.013	.047	.031	.026
Std.	.164	Std.	.029	.036	.030	.022	.031

Notes: The table provides the mean value (Mean), 20-percent percentiles (20%), median value (Median), 80-percent percentiles (80%), and standard deviations (Std.) of the differences of the Sharpe-Ratio and Adjusted Sharpe-Ratio between a buy-and-hold strategy and the outcomes of a rebalancing strategy for the same portfolios. Next to the mean values, the table provides the results of parametric t-tests that test whether the mean values differ from 0 at statistically significant levels. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Panel A includes portfolios of households which were interviewed in the 4th quarter 2010; Panel B (C) includes portfolios of households which were interviewed in the 1st quarter 2011 (2nd quarter 2011). Example: The portfolios of households which were interviewed in the 4th quarter 2010 achieve a .028 higher mean Sharpe-Ratio with monthly rebalancing strategies than with a buy-and-hold strategy. The higher mean Sharpe-Ratio is different from zero with a statistical significance at the one-percent level.

Table 48: Portfolio outcomes of rebalancing strategies compared to buy-and-hold-strategy over a 4 year period (cont'd)

Panel B: Households surveyed in first quarter 2011 (N=253)

Sharpe-Ratio Buy-and-hold strategy		Delta Sharpe-Ratio compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.729	Mean	-.004	-.007***	.004*	-.004*	-.014***
20%	.447	20%	-.018	-.029	-.013	-.018	-.033
Median	.745	Median	.000	.000	.003	-.002	-.007
80%	.900	80%	.011	.006	.018	.004	.002
Std.	.259	Std.	.035	.037	.038	.036	.028
Adjusted Sharpe-Ratio Buy-and-hold strategy		Delta Adjusted Sharpe-Ratio compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.640	Mean	-.017***	-.027***	-.015***	-.020***	-.021***
20%	.445	20%	-.043	-.054	-.041	-.045	-.044
Median	.652	Median	-.004	-.005	-.001	-.009	-.010
80%	.789	80%	.006	.005	.014	.001	.001
Std.	.188	Std.	.034	.075	.041	.034	.034

Panel C: Households surveyed in second quarter 2011 (N=351)

Sharpe-Ratio Buy-and-hold strategy		Delta Sharpe-Ratio compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.769	Mean	-.002	-.002	.004***	-.009***	-.016***
20%	.540	20%	-.011	-.022	-.006	-.021	-.033
Median	.800	Median	-.001	.000	.001	-.009	-.014
80%	.945	80%	.005	.015	.013	.000	.000
Std.	.195	Std.	.022	.029	.021	.023	.026
Adjusted Sharpe-Ratio Buy-and-hold strategy		Delta Adjusted Sharpe-Ratio compared to buy-and-hold-strategy					
			Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Mean	.703	Mean	-.021***	-.017***	-.024***	-.033***	-.031***
20%	.525	20%	-.047	-.055	-.061	-.064	-.066
Median	.705	Median	-.008	.000	-.003	-.021	-.020
80%	.871	80%	.001	.014	.007	-.004	-.000
Std.	.163	Std.	.035	.045	.046	.039	.041

I. Analyses of Section 7.2.2 regarding the relation between the initial asset allocation and the benefits from portfolio rebalancing subdivided by quarters

Table 49: Portfolio composition of winners and losers of rebalancing (Sharpe-Ratio) of Households surveyed in fourth quarter 2010 (N=226)

Panel A: Periodical rebalancing strategies

	Monthly Rebalancing			Annual Rebalancing		
	Enhanced SR_h	Reduced SR_h	Sig.	Enhanced SR_h	Reduced SR_h	Sig.
Mean (Median) asset class portfolio weight						
Money market	.423 (.386)	.453 (.459)		.399 (.362)	.451 (.403)	
Stocks	.293 (.216)	.027 (.000)	***	.392 (.320)	.145 (.000)	***
Bonds	.102 (.000)	.372 (.373)	***	.114 (.000)	.158 (.000)	
Real estate funds	.053 (.000)	.003 (.000)	*	.079 (.000)	.019 (.000)	***
Articles of great value	.129 (.000)	.145 (.000)		.017 (.000)	.227 (.140)	***
Mean annual μ (buy-and-hold)	.056	.042	**	.047	.060	***
Mean annual σ (buy-and-hold)	.087	.044	***	.088	.076	*
N	196	30		103	123	

Panel B: Threshold rebalancing strategies

	5%-Divergence rebalancing			10%-Divergence rebalancing			20%-Divergence rebalancing		
	Enhanced SR_h	Reduced SR_h	Sig.	Enhanced SR_h	Reduced SR_h	Sig.	Enhanced SR_h	Reduced SR_h	Sig.
Mean (Median) asset class portfolio weight									
Money market	.426 (.386)	.433 (.459)		.428 (.394)	.420 (.412)	**	.398 (.359)	.474 (.451)	**
Stocks	.275 (.199)	.080 (.000)	***	.272 (.199)	.162 (.000)		.364 (.302)	.085 (.000)	***
Bonds	.106 (.000)	.466 (.469)	***	.107 (.000)	.343 (.306)		.149 (.039)	.121 (.000)	
Real estate funds	.051 (.000)	.004 (.000)		.053 (.000)	.003 (.000)	***	.047 (.000)	.045 (.000)	
Articles of great value	.142 (.000)	.017 (.000)	**	.140 (.000)	.073 (.000)	**	.042 (.000)	.275 (.181)	***
Mean annual μ (buy-and-hold)	.057	.028	***	.057	.039	***	.048	.065	***
Mean annual σ (buy-and-hold)	.086	.034	***	.086	.055		.085	.077	
Mean #rebalances	59	17	***	16	7	***	4	2	***
N	206	20		196	30		140	86	

Notes: The table provides the mean and median (in parentheses) portfolio shares of each asset class for portfolios that show an enhanced/reduced Sharpe-Ratio by employing a rebalancing strategy than by employing a buy-and-hold strategy as well as the mean annual μ and mean annual σ that the portfolios would achieve with a buy-and-hold strategy. It is differentiated between periodical (Panel A) and threshold rebalancing strategies (Panel B). The table provides the results of parametric t-tests that test whether an asset class's mean portfolio share in the portfolios that show an enhanced Sharpe-Ratio (i.e. the winners) by employing a rebalancing strategy differ from an asset class's mean portfolio share in the portfolios that show a reduced Sharpe-Ratio by employing a rebalancing strategy (i.e. the losers) at statistically significant levels. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: The 196 portfolios that show an enhanced Sharpe-Ratio by employing a monthly rebalancing strategy have on average 42.3 percent of their portfolio value invested in *money market* while the 30 portfolios that show a reduced Sharpe-Ratio by employing a monthly rebalancing strategy have on average 45.3 percent of their portfolio value invested in *money market*. Both mean values do not differ from each other at a statistically significant level.

Table 50: Portfolio composition of winners and losers of rebalancing (Sharpe-Ratio) of Households surveyed in first quarter 2011 (N=253)

Panel A: Periodical rebalancing strategies

	Monthly rebalancing			Annual rebalancing		
	Enhanced SR_h	Reduced SR_h	Sig.	Enhanced SR_h	Reduced SR_h	Sig.
Mean (Median) asset class portfolio weight						
Money market	.422 (.404)	.493 (.494)	**	.427 (.433)	.474 (.489)	
Stocks	.361 (.328)	.138 (.011)	***	.301 (.217)	.210 (.100)	**
Bonds	.123 (.000)	.115 (.000)		.138 (.062)	.111 (.000)	
Real estate funds	.046 (.000)	.043 (.000)		.118 (.000)	.017 (.000)	***
Articles of great value	.048 (.000)	.211 (.104)	***	.016 (.000)	.187 (.053)	***
Mean annual μ (buy-and-hold)	.058	.066	*	.055	.065	**
Mean annual σ (buy-and-hold)	.085	.072	*	.074	.079	
N	110	143		69	184	

Panel B: Threshold rebalancing strategies

	5%-Divergence rebalancing			10%-Divergence rebalancing			20%-Divergence rebalancing		
	Enhanced SR_h	Reduced SR_h	Sig.	Enhanced SR_h	Reduced SR_h	Sig.	Enhanced SR_h	Reduced SR_h	Sig.
Mean (Median) asset class portfolio weight									
Money market	.430 (.400)	.501 (.534)	**	.445 (.505)	.468 (.479)		.429 (.373)	.471 (.487)	
Stocks	.337 (.258)	.111 (.000)	***	.243 (.155)	.232 (.110)		.330 (.202)	.208 (.100)	***
Bonds	.133 (.000)	.101 (.000)		.147 (.061)	.108 (.000)		.090 (.000)	.127 (.000)	
Real estate funds	.044 (.000)	.045 (.000)		.113 (.000)	.019 (.000)	***	.121 (.000)	.023 (.000)	***
Articles of great value	.057 (.000)	.241 (.164)	***	.051 (.000)	.173 (.030)	***	.029 (.000)	.172 (.031)	***
Mean annual μ (buy-and-hold)	.057	.068	**	.056	.064	*	.058	.063	
Mean annual σ (buy-and-hold)	.081	.073		.068	.081	*	.082	.076	
Mean #rebalances	63	50	***	17	15	***	4	4	***
N	139	114		68	185		56	197	

Notes: The table provides the mean and median (in parentheses) portfolio shares of each asset class for portfolios that show an enhanced/reduced Sharpe-Ratio by employing a rebalancing strategy instead of employing a buy-and-hold strategy as well as the mean annual μ and mean annual σ that the portfolios would achieve with a buy-and-hold strategy. It is differentiated between periodical (Panel A) and threshold rebalancing strategies (Panel B). The table provides the results of parametric t-tests that test whether an asset class's mean portfolio share in the portfolios that show an enhanced Sharpe-Ratio by employing a rebalancing strategy (i.e. the winners) differ from an asset class's mean portfolio share in the portfolios that show a reduced Sharpe-Ratio by employing a rebalancing strategy (i.e. the losers) at statistically significant levels. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: The 110 portfolios that show an enhanced Sharpe-Ratio by employing a monthly rebalancing strategy have, on average, 42.2 percent of their portfolio value invested in *money market* while the 143 portfolios that show a reduced Sharpe-Ratio by employing a monthly rebalancing strategy have on average 49.3 percent of their portfolio value invested in *money market*. Both mean values differ from each other with a statistical significance at the five-percent level.

Table 51: Portfolio composition of winners and losers of rebalancing (Sharpe-Ratio) of Households surveyed in second quarter 2011 (N=351)

Panel A: Periodical rebalancing strategies

	Monthly Rebalancing			Annual Rebalancing		
	Enhanced SR_h	Reduced SR_h	Sig.	Enhanced SR_h	Reduced SR_h	Sig.
Mean (Median) asset class portfolio weight						
Money market	.301 (.223)	.517 (.554)	***	.452 (.484)	.454 (.454)	
Stocks	.314 (.270)	.200 (.115)	***	.331 (.321)	.157 (.000)	***
Bonds	.215 (.146)	.098 (.000)	***	.124 (.000)	.140 (.000)	
Real estate funds	.097 (.000)	.010 (.000)	***	.075 (.000)	.004 (.000)	***
Articles of great value	.074 (.000)	.176 (.025)	***	.019 (.000)	.245 (.156)	***
Mean annual μ (buy-and-hold)	.072	.067		.060	.075	***
Mean annual σ (buy-and-hold)	.087	.076	*	.077	.081	
N	103	248		154	197	

Panel B: Threshold rebalancing strategies

	5%-Divergence Rebalancing			10%-Divergence Rebalancing			20%-Divergence Rebalancing		
	Enhanced SR_h	Reduced SR_h	Sig.	Enhanced SR_h	Reduced SR_h	Sig.	Enhanced SR_h	Reduced SR_h	Sig.
Mean (Median) asset class portfolio weight									
Money market	.407 (.412)	.501 (.545)	***	.334 (.249)	.473 (.500)	***	.345 (.285)	.469 (.491)	***
Stocks	.322 (.292)	.140 (.000)	***	.151 (.007)	.246 (.156)	**	.278 (.208)	.227 (.125)	
Bonds	.153 (.000)	.111 (.000)	*	.208 (.114)	.120 (.000)	**	.137 (.003)	.132 (.000)	
Real estate funds	.056 (.000)	.014 (.000)	***	.188 (.164)	.011 (.000)	***	.204 (.175)	.011 (.000)	***
Articles of great value	.063 (.000)	.233 (.144)	***	.120 (.000)	.150 (.000)		.036 (.000)	.162 (.009)	***
Mean annual μ (buy-and-hold)	.065	.072	*	.072	.068	***	.069	.068	
Mean annual σ (buy-and-hold)	.082	.076		.071	.080		.080	.079	
Mean #rebalances	58	49	***	16	14	***	6	4	***
N	179	172		49	302		44	307	

Notes: The table provides the mean and median (in parentheses) portfolio shares of each asset class for portfolios that show an enhanced/reduced Sharpe-Ratio by employing a rebalancing strategy instead of employing a buy-and-hold strategy as well as the mean annual μ and mean annual σ that the portfolios would achieve with a buy-and-hold strategy. It is differentiated between periodical (Panel A) and threshold rebalancing strategies (Panel B). The table provides the results of parametric t-tests that test whether an asset class's mean portfolio share in the portfolios that show an enhanced Sharpe-Ratio by employing a rebalancing strategy (i.e. the winners) differ from an asset class's mean portfolio share in the portfolios that show a reduced Sharpe-Ratio by employing a rebalancing strategy (i.e. the losers) at statistically significant levels. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: The 103 portfolios that show an enhanced Sharpe-Ratio by employing a monthly rebalancing strategy have, on average, 30.1 percent of their portfolio value invested in *money market* while the 248 portfolios that show a reduced Sharpe-Ratio by employing a monthly rebalancing strategy have on average 51.7 percent of their portfolio value invested in *money market*. Both mean values differ from each other with a statistical significance at the one-percent level.

Table 52: Portfolio composition of winners and losers of rebalancing (ASR-Factor) of Households surveyed in fourth quarter 2010 (N=226)

Panel A: Periodical rebalancing strategies

	Monthly Rebalancing			Annual Rebalancing		
	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.
Mean (Median) asset class portfolio weight						
Money market	.399 (.319)	.441 (.405)		.420 (.422)	.433 (.387)	
Stocks	.367 (.273)	.201 (.113)	***	.426 (.404)	.096 (.000)	***
Bonds	.203 (.080)	.105 (.000)	***	.131 (.000)	.145 (.000)	
Real estate funds	.011 (.000)	.064 (.000)	***	.012 (.000)	.079 (.000)	***
Articles of great value	.020 (.000)	.188 (.081)	***	.011 (.000)	.247 (.159)	***
Mean annual μ (buy-and-hold)	.043	.043	***	.044	.064	***
Mean annual σ (buy-and-hold)	.082	.082		.090	.073	**
N	77	149		111	115	

Panel B: Threshold rebalancing strategies

	5%-Divergence Rebalancing			10%-Divergence Rebalancing			20%-Divergence Rebalancing		
	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.
Mean (Median) asset class portfolio weight									
Money market	.443 (.504)	.425 (.387)		.394 (.393)	.421 (.398)		.390 (.350)	.469 (.431)	**
Stocks	.103 (.000)	.272 (.192)	**	.119 (.000)	.274 (.195)	***	.395 (.330)	.103 (.033)	***
Bonds	.436 (.410)	.111 (.000)	***	.407 (.380)	.106 (.000)	***	.146 (.000)	.129 (.000)	
Real estate funds	.000 (.000)	.051 (.000)		.022 (.000)	.049 (.000)		.031 (.000)	.064 (.000)	*
Articles of great value	.018 (.000)	.141 (.001)	**	.058 (.000)	.140 (.000)	*	.039 (.000)	.235 (.138)	***
Mean annual μ (buy-and-hold)	.029	.057	***	.037	.056	***	.048	.062	***
Mean annual σ (buy-and-hold)	.037	.086	***	.048	.086	***	.090	.072	***
Mean #rebalances	16	59	***	5	16	***	3	3	
N	19	207		24	202		120	106	

Notes: The table provides the mean and median (in parentheses) portfolio shares of each asset class for portfolios that show an enhanced/reduced Adjusted Sharpe-Ratio Factor (ASR-Factor) by employing a rebalancing strategy instead of employing a buy-and-hold strategy as well as the mean annual μ and mean annual σ that the portfolios would achieve with a buy-and-hold strategy. It is differentiated between periodical (Panel A) and threshold rebalancing strategies (Panel B). The table provides the results of parametric t-tests that test whether an asset class's mean portfolio share in the portfolios that show an enhanced ASR-Factor by employing a rebalancing strategy (i.e. the winners) differ from an asset class's mean portfolio share in the portfolios that show a reduced ASR-Factor by employing a rebalancing strategy (i.e. the losers) at statistically significant levels. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: The 77 portfolios that show an enhanced ASR-Factor by employing a monthly rebalancing strategy have, on average, 39.9 percent of their portfolio value invested in *money market* while the 149 portfolios that show a reduced ASR-Factor by employing a monthly rebalancing strategy have on average 44.1 percent of their portfolio value invested in *money market*. Both mean values do not differ from each other at a statistically significant level.

Table 53: Portfolio composition of winners and losers of rebalancing (ASR-Factor) of Households surveyed in first quarter 2011 (N=253)

Panel A: Periodical rebalancing strategies

	Monthly Rebalancing			Annual Rebalancing		
	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.
Mean (Median) asset class portfolio weight						
Money market	.373 (401)	.473 (.488)		.274 (.098)	.490 (.499)	***
Stocks	.239 (.106)	.235 (.154)		.414 (.481)	.208 (.116)	***
Bonds	.288 (.249)	.097 (.000)	***	.160 (.079)	.113 (.000)	
Real estate funds	.032 (.000)	.046 (.000)		.037 (.000)	.046 (.000)	
Articles of great value	.068 (.000)	.149 (.005)	*	.116 (.000)	.144 (.000)	
Mean annual μ (buy-and-hold)	.054	.063		.072	.061	*
Mean annual σ (buy-and-hold)	.068	.079		.108	.073	***
N	29	224		33	220	

Panel B: Threshold rebalancing strategies

	5%-Divergence Rebalancing			10%-Divergence Rebalancing			20%-Divergence Rebalancing		
	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.
Mean (Median) asset class portfolio weight									
Money market	.309 (.245)	.472 (.488)	**	.352 (.374)	.470 (.487)		.370 (.346)	.478 (.489)	*
Stocks	.317 (.089)	.230 (.144)		.295 (.054)	.231 (.149)		.224 (.002)	.237 (.156)	
Bonds	.241 (.214)	.110 (.000)	***	.238 (.212)	.110 (.000)	***	.297 (.249)	.088 (.000)	***
Real estate funds	.026 (.000)	.046 (.000)		.026 (.000)	.046 (.000)		.044 (.000)	.045 (.000)	
Articles of great value	.107 (.000)	.142 (.000)		.089 (.000)	.144 (.000)		.066 (.000)	.153 (.013)	**
Mean annual μ (buy-and-hold)	.065	.062		.060	.062		.054	.063	
Mean annual σ (buy-and-hold)	.088	.077		.081	.077		.067	.079	
Mean #rebalances	51	57		13	15	**	3	4	***
N	16	237		18	235		37	216	

Notes: The table provides the mean and median (in parentheses) portfolio shares of each asset class for portfolios that show an enhanced/reduced Adjusted Sharpe-Ratio Factor (ASR-Factor) by employing a rebalancing strategy instead of employing a buy-and-hold strategy as well as the mean annual μ and mean annual σ that the portfolios would achieve with a buy-and-hold strategy. It is differentiated between periodical (Panel A) and threshold rebalancing strategies (Panel B). The table provides the results of parametric t-tests that test whether an asset class's mean portfolio share in the portfolios that show an enhanced ASR-Factor by employing a rebalancing strategy (i.e. the winners) differ from an asset class's mean portfolio share in the portfolios that show a reduced ASR-Factor by employing a rebalancing strategy (i.e. the losers) at statistically significant levels. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: The 29 portfolios that show an enhanced ASR-Factor by employing a monthly rebalancing strategy have, on average, 37.3 percent of their portfolio value invested in *money market* while the 224 portfolios that show a reduced ASR-Factor by employing a monthly rebalancing strategy have on average 47.3 percent of their portfolio value invested in *money market*. Both mean values do not differ from each other at a statistically significant level.

Table 54: Portfolio composition of winners and losers of rebalancing (ASR-Factor) of Households surveyed in second quarter 2011 (N=351)

Panel A: Periodical rebalancing strategies

	Monthly Rebalancing			Annual Rebalancing		
	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.
Mean (Median) asset class portfolio weight						
Money market	.347 (.312)	.466 (.492)	**	.443 (.447)	.460 (.487)	
Stocks	.095 (.000)	.250 (.171)	***	.323 (.306)	.178 (.000)	***
Bonds	.475 (.477)	.091 (.000)	***	.174 (.111)	.107 (.000)	***
Real estate funds	.022 (.000)	.037 (.000)		.037 (.000)	.035 (.000)	
Articles of great value	.061 (.000)	.156 (.014)	**	.024 (.000)	.221 (.133)	***
Mean annual μ (buy-and-hold)	.046	.071	***	.057	.075	***
Mean annual σ (buy-and-hold)	.044	.083	***	.072	.083	**
N	38	313		133	218	

Panel B: Threshold rebalancing strategies

	5%-Divergence Rebalancing			10%-Divergence Rebalancing			20%-Divergence Rebalancing		
	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.	Enhanced ASR-Factor	Reduced ASR-Factor	Sig.
Mean (Median) asset class portfolio weight									
Money market	.383 (.347)	.461 (.485)		.324 (.218)	.460 (.485)	*	.348 (.338)	.467 (.496)	**
Stocks	.106 (.000)	.247 (.164)	***	.180 (.079)	.236 (.153)		.090 (.000)	.252 (.172)	***
Bonds	.419 (.439)	.102 (.000)	***	.321 (.264)	.122 (.000)	***	.476 (.479)	.087 (.000)	***
Real estate funds	.025 (.000)	.036 (.000)		.047 (.000)	.035 (.000)		.028 (.000)	.036 (.000)	
Articles of great value	.068 (.000)	.154 (.012)	**	.128 (.000)	.147 (.000)		.058 (.000)	.158 (.015)	**
Mean annual μ (buy-and-hold)	.047	.071	***	.064	.069		.046	.071	***
Mean annual σ (buy-and-hold)	.046	.083	***	.067	.080		.044	.084	***
Mean #rebalances	29	57	***	13	15		2	5	***
N	34	317		18	333		41	310	

Notes: The table provides the mean and median (in parentheses) portfolio shares of each asset class for portfolios that show an enhanced/reduced Adjusted Sharpe-Ratio Factor (ASR-Factor) by employing a rebalancing strategy instead of employing a buy-and-hold strategy as well as the mean annual μ and mean annual σ that the portfolios would achieve with a buy-and-hold strategy. It is differentiated between periodical (Panel A) and threshold rebalancing strategies (Panel B). The table provides the results of parametric t-tests that test whether an asset class's mean portfolio share in the portfolios that show an enhanced ASR-Factor by employing a rebalancing strategy (i.e. the winners) differ from an asset class's mean portfolio share in the portfolios that show a reduced ASR-Factor by employing a rebalancing strategy (i.e. the losers) at statistically significant levels. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Example: The 38 portfolios that show an enhanced ASR-Factor by employing a monthly rebalancing strategy have, on average, 34.7 percent of their portfolio value invested in *money market* while the 313 portfolios that show a reduced ASR-Factor by employing a monthly rebalancing strategy have on average 46.6 percent of their portfolio value invested in *money market*. Both mean values differ from each other with a statistical significance at the five-percent level.

Table 55: Influence of households' investment policy on the success of rebalancing strategies measured as increase in Sharpe-Ratio over a 4 year period

Panel A: Households surveyed in fourth quarter 2010 (N=226)

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Money market	Omitted	Omitted	Omitted	Omitted	Omitted
Stocks	-.019*** (.006)	.020*** (.005)	-.037*** (.006)	-.030*** (.005)	.008 (.005)
Bonds	-.012* (.007)	.015** (.007)	-.020*** (.007)	-.006 (.007)	.036*** (.007)
Real estate funds	-.005 (.011)	.028*** (.010)	-.035*** (.011)	-.010 (.010)	.012 (.010)
Articles of great value	-.056*** (.008)	-.032*** (.007)	-.059*** (.008)	-.033*** (.007)	-.027*** (.007)
β_0	.042*** (.003)	-.006* (.003)	.054*** (.003)	.037*** (.003)	.006** (.003)
R^2	.214	.276	.236	.160	.268
R^2 adj.	.200	.263	.222	.144	.255
F-Test	15.022	21.079	17.051	10.493	20.211
VIF (highest value among all independent variables)	1.444	1.444	1.444	1.444	1.444

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R^2, adjusted R^2 (R^2 adj.), and F-statistics (F-Test), and VIF for the regression analysis using equation (10) with the increase of the Sharpe-Ratio resulting from the usage of rebalancing strategies instead of a buy-and-hold strategy as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Panel A includes portfolios of households which were interviewed in the 4th quarter 2010; Panel B (C) includes portfolios of households which were interviewed in the 1st quarter 2011 (2nd quarter 2011). Example: Regressing the increase of the Sharpe-Ratio with a monthly rebalancing strategy of the portfolios of households which were interviewed in the 4th quarter 2010 on the model of equation (10) yields a coefficient of the percentage of stocks in the portfolio of -.019 with a statistical significance at the one-percent level and an adjusted R^2 of .200.

Table 55: Influence of households' investment policy on the success of rebalancing strategies measured as increase in Sharpe-Ratio over a 4 year period (cont'd)

Panel B: Households surveyed in first quarter 2011 (N=253)					
	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Asset Class's Portfolio Share					
Money market	Omitted	Omitted	Omitted	Omitted	Omitted
Stocks	.019** (.009)	.021** (.009)	.005 (.010)	.003 (.009)	.037*** (.007)
Bonds	.018 (.012)	.021* (.012)	.010 (.013)	.010 (.013)	.026*** (.009)
Real estate funds	.018 (.017)	.062*** (.017)	-.004 (.019)	.042** (.017)	.058*** (.012)
Articles of great value	-.010 (.011)	-.023** (.011)	-.026** (.012)	-.008 (.011)	-.007 (.008)
β_0	-.010 (.005)	-.014*** (.005)	.006 (.005)	-.006 (.005)	-.027*** (.003)
R^2	.045	.118	.035	.033	.205
R^2 adj.	.029	.103	.020	.017	.192
F-Test	2.897	8.266	2.276	2.109	15.950
VIF (highest value among all independent variables)	1.320	1.320	1.320	1.320	1.320

Table 55: Influence of households' investment policy on the success of rebalancing strategies measured as increase in Sharpe-Ratio over a 4 year period (cont'd)

Panel C: Households surveyed in second quarter 2011 (N=351)

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Asset Class's Portfolio Share					
Money market	Omitted	Omitted	Omitted	Omitted	Omitted
Stocks	.007 (.005)	.021*** (.006)	.001 (.005)	.009* (.005)	.036*** (.005)
Bonds	.025*** (.005)	.019*** (.007)	.015*** (.005)	.026*** (.006)	.034*** (.006)
Real estate funds	.054*** (.011)	.082*** (.014)	.025** (.011)	.069*** (.011)	.099*** (.012)
Articles of great value	.001 (.006)	-.025*** (.007)	-.012** (.006)	.015** (.006)	.009 (.006)
β_0	-.008 (.002)	-.009*** (.003)	.003 (.002)	-.019*** (.003)	-.033*** (.003)
R^2	.117	.222	.070	.132	.270
R^2 adj.	.107	.213	.059	.122	.262
F-Test	11.517	24.720	6.462	13.105	32.054
VIF (highest value among all independent variables)	1.474	1.474	1.474	1.474	1.474

Table 56: Influence of households' investment policy on the success of rebalancing strategies measured as increase in ASR-Factor over a 4 year period

Panel A: Households surveyed in fourth quarter 2010 (N=226)

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Asset Class's Portfolio Share					
Money market	Omitted	Omitted	Omitted	Omitted	Omitted
Stocks	.028*** (.004)	.058*** (.017)	.045*** (.006)	.036*** (.004)	.032*** (.005)
Bonds	.008* (.005)	.042** (.021)	.022*** (.007)	.015*** (.006)	.019*** (.006)
Real estate funds	.016** (.007)	.043 (.030)	.025** (.010)	.021** (.008)	.020** (.008)
Articles of great value	-.006 (.005)	.023 (.021)	-.007 (.007)	-.004 (.006)	-.007 (.006)
β_0	-.018*** (.002)	-.038*** (.009)	-.030*** (.003)	-.024*** (.002)	-.020** (.003)
R^2	.285	.057	.322	.306	.269
R^2 adj.	.272	.040	.310	.294	.256
F-Test	22.028	3.336	26.289	24.407	20.306
VIF (highest value among all independent variables)	1.444	1.444	1.444	1.444	1.444

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R^2, adjusted R^2 (R^2 adj.), and F-statistics (F-Test), and VIF for the regression analysis using equation (11) with the increase of the Adjusted Sharpe-Ratio Factor (ASR-Factor) resulting from the usage of rebalancing strategies instead of a buy-and-hold strategy as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Panel A includes portfolios of households which were interviewed in the 4th quarter 2010; Panel B (C) includes portfolios of households which were interviewed in the 1st quarter 2011 (2nd quarter 2011). Example: Regressing the increase of the ASR-Factor with a monthly rebalancing strategy of the portfolios of households which were interviewed in the 4th quarter 2010 on the model of equation (11) yields a coefficient of the percentage of stocks in the portfolio of .028 with a statistical significance at the one-percent level and an adjusted R^2 of .272.

Table 56: Influence of households' investment policy on the success of rebalancing strategies measured as increase in ASR-Factor over a 4 year period (cont'd)

Panel B: Households surveyed in first quarter 2011 (N=253)					
	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Asset Class's Portfolio Share					
Money market	Omitted	Omitted	Omitted	Omitted	Omitted
Stocks	.040** (.007)	.090** (.022)	.055*** (.008)	.049*** (.008)	.025*** (.004)
Bonds	.021** (.009)	.076*** (.029)	.033*** (.010)	.033*** (.010)	.015*** (.005)
Real estate funds	.026** (.012)	.075* (.040)	.026* (.014)	.033** (.014)	.015*** (.007)
Articles of great value	-.002 (.008)	.066** (.026)	-.008 (.009)	.003 (.009)	-.001 (.004)
β_0	-.027*** (.003)	-.068*** (.011)	-.038*** (.004)	-.036*** (.004)	-.018*** (.002)
R^2	.167	.075	.233	.178	.208
R^2 adj.	.153	.060	.220	.165	.195
F-Test	12.393	5.003	18.818	13.454	16.263
VIF (highest value among all independent variables)	1.320	1.320	1.320	1.320	1.320

Table 56: Influence of households' investment policy on the success of rebalancing strategies measured as increase in ASR-Factor over a 4 year period (cont'd)

Panel C: Households surveyed in second quarter 2011 (N=351)

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
Asset Class's Portfolio Share					
Money market	Omitted	Omitted	Omitted	Omitted	Omitted
Stocks	.062*** (.006)	.056*** (.006)	.090*** (.008)	.076*** (.007)	.054*** (.005)
Bonds	.048*** (.006)	.039*** (.006)	.066*** (.009)	.057*** (.007)	.043*** (.006)
Real estate funds	.049*** (.013)	.041*** (.012)	.058*** (.017)	.056*** (.015)	.045*** (.011)
Articles of great value	.000 (.007)	-.008 (.006)	-.002 (.009)	.001 (.008)	-.001 (.006)
β_0	-.044*** (.003)	-.034*** (.003)	-.062 (.004)	-.054*** (.003)	-.039*** (.003)
R^2	.360	.356	.395	.377	.353
R^2 adj.	.353	.348	.388	.370	.346
F-Test	48.698	47.774	56.425	52.3705	47.247
VIF (highest value among all independent variables)	1.474	1.474	1.474	1.474	1.474

Table 57: Influence of households' characteristics on the Asset Classes' Portfolio Share

Panel A: Households surveyed in fourth quarter 2010 (N=226)					
	Money market	Stocks	Bonds	Real estate funds	Articles of great value
$lnValueSP_h$	-.055*** (.018)	.035* (.019)	.024 (.015)	.012 (.010)	-.015 (.016)
$AboveAverageRisk_h$	-.221** (.085)	.257*** (.087)	.058 (.072)	.008 (.044)	-.104 (.073)
$NoRisk_h$	.048 (.039)	-.101** (.040)	.023 (.033)	.012 (.020)	.019 (.033)
Age_h	-.005 (.008)	.001 (.008)	.003 (.006)	.005 (.004)	-.003 (.007)
${Age^2}_h$	.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)	.000 (.000)
$Female$	-.023 (.038)	.038 (.039)	.009 (.032)	-.012 (.020)	-.012 (.033)
$lnTWealth_h$	.005 (.018)	.034* (.018)	-.001 (.015)	-.006 (.009)	-.031** (.015)
$lnIncome_h$	.012 (.039)	-.047 (.040)	.005 (.033)	-.047** (.020)	.077** (.033)
$Child_h$	-.009 (.059)	.037 (.061)	.033 (.050)	-.017 (.031)	-.044 (.051)
β_0	1.052*** (.302)	-.111 (.310)	-.287 (.256)	.223 (.158)	.122 (.260)
R^2	.114	.139	.039	.066	.049
R^2 adj.	.077	.102	-.001	.027	.009
F-Test	3.069	3.828	.977	1.690	1.224

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R^2, adjusted R^2 (R^2 adj.), and F-statistics (F-Test) for the regression analysis with the portfolio shares of the asset classes *money market*, *stocks*, *bonds*, *real estate funds*, and *articles of great value* as dependent variables and households' socio-demographics and -economics as independent variables. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Panel A includes portfolios of households which were interviewed in the 4th quarter 2010; Panel B (C) includes portfolios of households which were interviewed in the 1st quarter 2011 (2nd quarter 2011). Example: Regressing households' portfolio share of *money market* of households which were interviewed in the 4th quarter 2010 on households' socio-demographics and –economics yields a coefficient of household's logarithmized portfolio value ($lnValueSP_h$) of -.055 with a statistical significance at the one-percent level and an adjusted R^2 of .077.

Table 57: Influence of households' characteristics on the Asset Classes' Portfolio Share (cont'd)

Panel B: Households surveyed in first quarter 2011 (N=253)

	Money market	Stocks	Bonds	Real estate funds	Articles of great value
$lnValueSP_h$	-.027 (.018)	.003 (.017)	.043*** (.012)	.006 (.008)	-.025* (.015)
$AboveAverageRisk_h$	-.138* (.083)	.261*** (.077)	-.034 (.056)	-.020 (.039)	-.069** (.068)
$NoRisk_h$	.056 (.041)	-.137*** (.038)	.015 (.028)	.005 (.019)	.062* (.034)
Age_h	.002 (.009)	-.011 (.008)	-.001 (.006)	-.001 (.004)	.011 (.007)
$Age^2{}_h$	-.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)	-.000 (.000)
$Female$	.044 (.038)	-.076** (.036)	.011 (.026)	.010 (.018)	.011 (.031)
$lnTWealth_h$	.029 (.019)	.006 (.018)	-.002 (.013)	-.005 (.009)	-.028* (.016)
$lnIncome_h$	-.012 (.037)	.010 (.035)	.003 (.025)	-.003 (.017)	.002** (.030)
$Child_h$	-.008 (.056)	-.009 (.052)	.018 (.038)	-.020 (.026)	.019 (.046)
β_0	.530* (.317)	.393 (.296)	-.395* (.216)	.065 (.149)	.407 (.258)
R^2	.074	.155	.089	.014	.093
R^2 adj.	.039	.123	.055	-.023	.059
F-Test	2.134	4.904	2.610	.948	2.755

Table 57: Influence of households' characteristics on the Asset Classes' Portfolio Share (cont'd)

Panel C: Households surveyed in second quarter 2011 (N=351)	Money market	Stocks	Bonds	Real estate funds	Articles of great value
$lnValueSP_h$	-.031** (.015)	.012 (.014)	.036*** (.013)	.006 (.006)	-.023* (.013)
$AboveAverageRisk_h$	-.165** (.064)	.294*** (.057)	-.049 (.052)	-.019 (.025)	-.061 (.054)
$NoRisk_h$	.080** (.032)	-.133*** (.028)	-.010 (.026)	-.023* (.012)	.087 (.027)
Age_h	.005 (.006)	-.001 (.006)	.001 (.005)	.002 (.003)	-.008 (.006)
$Age^2{}_h$	-.000 (.000)	.000 (.000)	-.000 (.000)	-.000 (.000)	.000 (.000)
$Female$	-.019 (.030)	-.075*** (.027)	.015 (.025)	.019 (.012)	.060** (.026)
$lnTWealth_h$	.004 (.015)	-.005 (.013)	.005 (.012)	.010* (.006)	-.014 (.013)
$lnIncome_h$	.015 (.031)	-.020 (.028)	-.015 (.025)	-.017** (.012)	.037 (.026)
$Child_h$	.056 (.045)	.064 (.040)	-.038 (.036)	-.020 (.017)	-.061 (.038)
β_0	.504** (.248)	.355 (.221)	-.258 (.203)	-.064 (.096)	.463** (.212)
R^2	.075	.199	.064	.053	.113
R^2 adj.	.055	.178	.039	.029	.090
F-Test	3.244	9.441	2.580	2.141	4.833

Table 58: Influence of households' characteristics on the success of rebalancing strategies measured as increase in Sharpe-Ratio (△SR) over a 4 year period

Panel A: Households surveyed in fourth quarter 2010 (N=226)

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
$lnValueSP_h$	.001 (.002)	.003 (.002)	-.001 (.002)	-.001 (.001)	.004** (.002)
$AboveAverageRisk_h$	-.002 (.008)	.003 (.007)	-.003 (.008)	-.007 (.007)	.001 (.007)
$NoRisk_h$	-.004 (.003)	-.006* (.003)	-.008** (.004)	-.005 (.003)	-.006* (.003)
Age_h	-.001 (.001)	.000 (.001)	.000 (.001)	-.000 (.001)	-.001 (.001)
$Age^2{}_h$	.000 (.000)	-.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)
$Female_h$	-.002 (.003)	.001 (.003)	.000 (.004)	-.002 (.003)	.000 (.003)
$lnTWealth_h$	.002 (.002)	.002 (.002)	.001 (.002)	.000 (.001)	.002 (.001)
$lnIncome_h$	-.004 (.003)	-.007** (.003)	-.003 (.004)	-.002 (.003)	-.004 (.003)
$Child_h$	.003 (.005)	.006 (.005)	.008 (.006)	.001 (.005)	.012** (.005)
β_0	.060** (.027)	-.002 (.026)	.060 (.028)	.045* (.024)	-.003 (.025)
R²	.040	.052	.037	.022	.091
R² adj.	.000	.013	-.003	-.019	.053
F-Test	.992	1.317	.914	.546	2.373

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R², adjusted R^2 (R² adj.), and F-statistics (F-Test) for the regression analysis using equation (12) with the increase of the Sharpe-Ratio resulting from the usage of rebalancing strategies instead of a buy-and-hold strategy as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Panel A includes portfolios of households which were interviewed in the 4th quarter 2010; Panel B (C) includes portfolios of households which were interviewed in the 1st quarter 2011 (2nd quarter 2011). Example: Regressing the increase of the Sharpe-Ratio of portfolios of households which were interviewed in the 4th quarter 2010 with a monthly rebalancing strategy on the model of equation (12) yields a coefficient of household's logarithmized portfolio value ($lnValueSP_h$) of .001 with no statistical significance and an adjusted R² of .000.

Table 58: Influence of households' characteristics on the success of rebalancing strategies measured as increase in Sharpe-Ratio (△SR) over a 4 year period (cont'd)

Panel B: Households surveyed in first quarter 2011 (N=253)

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
$lnValueSP_h$	.003 (.002)	.004 (.002)	.003 (.002)	.002 (.002)	.002 (.002)
$AboveAverageRisk_h$	.006 (.010)	.002 (.011)	-.001 (.011)	.005 (.011)	.003 (.008)
$NoRisk_h$	.002 (.005)	-.001 (.005)	-.002 (.006)	.002 (.005)	-.006 (.004)
Age_h	-.001 (.001)	-.001 (.001)	-.002 (.001)	-.001 (.001)	-.001 (.001)
$Age^2{}_h$	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)
$Female_h$	-.003 (.005)	-.008 (.005)	.000 (.005)	-.003 (.005)	-.005 (.004)
$lnTWealth_h$	.002 (.002)	.002 (.003)	.002 (.003)	.001 (.003)	.001 (.002)
$lnIncome_h$	-.001 (.005)	-.002 (.005)	.002 (.005)	.000 (.005)	-.003 (.004)
$Child_h$	-.013 (.007)	-.014* (.007)	-.014* (.008)	-.015 (.007)	-.009* (.006)
β_0	-.015 (.040)	-.023 (.042)	.005 (.044)	-.010 (.041)	.025 (.032)
R^2	.042	.068	.060	.034	.064
R^2 adj.	.006	.033	.025	-.002	.029
F-Test	1.179	1.948	1.722	.947	1.842

Table 58: Influence of households' characteristics on the success of rebalancing strategies measured as increase in Sharpe-Ratio (△SR) over a 4 year period (cont'd)

Panel C: Households surveyed in second quarter 2011 (N=351)

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
$lnValueSP_h$	.001 (.001)	.002 (.002)	-.000 (.001)	.000 (.001)	.001 (.002)
$AboveAverageRisk_h$	-.003 (.005)	.000 (.007)	-.005 (.005)	-.001 (.006)	.003 (.006)
$NoRisk_h$	-.003 (.003)	-.008** (.003)	-.005** (.002)	-.002 (.003)	-.007** (.003)
Age_h	.000 (.000)	.001* (.001)	.001 (.001)	.000 (.001)	.001 (.001)
$Age^2{}_h$	-.000 (.000)	-.000* (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
$Female_h$	-.002 (.003)	-.003 (.003)	-.004 (.002)	-.001 (.003)	-.003* (.003)
$lnTWealth_h$	.000 (.001)	.000 (.002)	-.001 (.001)	-.001 (.001)	-.001 (.001)
$lnIncome_h$	.000 (.003)	-.001 (.003)	.002 (.002)	.001 (.003)	.000 (.003)
$Child_h$	.005 (.004)	.005 (.005)	.008** (.004)	.005 (.004)	.008* (.004)
β_0	-.025 (.020)	-.043 (.027)	-.019 (.020)	-.023 (.022)	-.034 (.024)
R^2	.021	.049	.053	.009	.047
R^2 adj.	-.004	.024	.028	-.017	.021
F-Test	.827	1.944	2.134	.358	1.850

Table 59: Influence of households' characteristics on the success of rebalancing strategies measured as increase in ASR-Factor (△ASRFactor) over a 4 year period

Panel A: Households surveyed in fourth quarter 2010 (N=226)

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
$lnValueSP_h$	.002** (.001)	.001 (.004)	.003** (.002)	.003** (.001)	.004*** (.001)
$AboveAverageRisk_h$	.005 (.005)	.008 (.020)	.009 (.008)	.007 (.006)	.007 (.006)
$NoRisk_h$	-.001 (.002)	.005 (.009)	-.001 (.003)	-.001 (.003)	-.003 (.003)
Age_h	.000 (.000)	-.002 (.002)	.000 (.001)	.000 (.001)	.000 (.001)
$Age^2{}_h$	-.000 (.000)	.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
$Female_h$	.001 (.002)	.009 (.009)	.000 (.003)	.001 (.003)	.001 (.003)
$lnTWealth_h$	.001 (.001)	.004 (.004)	.002 (.002)	.001 (.001)	.001 (.001)
$lnIncome_h$	-.001 (.002)	.008 (.009)	-.002 (.003)	-.001 (.003)	-.001 (.003)
$Child_h$	.004 (.003)	.011 (.014)	.006 (.005)	.004 (.004)	.007* (.005)
β_0	-.043** (.018)	-.087 (.071)	-.057** (.027)	-.046** (.022)	-.049** (.021)
R²	.094	.038	.086	.083	.109
R² adj.	.056	-.002	.048	.045	.071
F-Test	2.468	.939	2.249	2.159	2.905

Notes: The table provides regression coefficients, their respective standard errors (in parentheses), R², adjusted R^2 (R² adj.), and F-statistics (F-Test) for the regression analysis using equation (13) with the increase of the Adjusted Sharpe-Ratio Factor (ASR-Factor) resulting from the usage of rebalancing strategies instead of a buy-and-hold strategy as dependent variable. The symbols ***, **, and * denote statistical significance at the one-, five-, and ten-percent level, respectively. Panel A includes portfolios of households which were interviewed in the 4th quarter 2010; Panel B (C) includes portfolios of households which were interviewed in the 1st quarter 2011 (2nd quarter 2011). Example: Regressing the increase of the ASR-Factor of portfolios of households which were interviewed in the 4th quarter 2010 with a monthly rebalancing strategy on the model of equation (13) yields a coefficient of household's logarithmized portfolio value ($lnValueSP_h$) of .002 with a statistical significance at the five-percent level and an adjusted R² of .056.

Table 59: Influence of households' characteristics on the success of rebalancing strategies measured as increase in ASR-Factor (△ASRFactor) over a 4 year period (cont'd)

Panel B: Households surveyed in first quarter 2011 (N=253)

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
$lnValueSP_h$	.001 (.002)	-.001 (.006)	.001 (.002)	.001 (.002)	.001 (.001)
$AboveAverageRisk_h$	-.002 (.008)	.026 (.026)	.000 (.010)	.002 (.009)	-.001 (.004)
$NoRisk_h$	-.010** (.004)	-.008 (.013)	-.013*** (.005)	-.013 (.005)	-.005** (.002)
Age_h	.000 (.001)	.000 (.003)	-.001 (.001)	-.001 (.001)	.000 (.000)
$Age^2{}_h$	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)
$Female_h$	-.006* (.004)	-.014 (.012)	-.008* (.005)	-.005 (.004)	-.005** (.002)
$lnTWealth_h$	.002 (.004)	-.001 (.006)	-.001 (.002)	-.001 (.002)	-.001 (.001)
$lnIncome_h$	.005 (.005)	.007 (.011)	.003 (.004)	.003 (.004)	.001 (.002)
$Child_h$	-.013 (.007)	-.017 (.017)	.004 (.007)	-.003 (.006)	.002 (.003)
β_0	-.001 (.031)	-.052 (.098)	-.012 (.037)	-.023 (.036)	-.013 (.017)
R^2	.063	.026	.080	.067	.091
R^2 adj.	.028	-.010	.046	.032	.057
F-Test	1.810	.727	2.327	1.928	2.674

Table 59: Influence of households' characteristics on the success of rebalancing strategies measured as increase in ASR-Factor (△ASRFactor) over a 4 year period (cont'd)

Panel C: Households surveyed in second quarter 2011 (N=351)

	Monthly Rebalancing	Annual Rebalancing	5%-Divergence Rebalancing	10%-Divergence Rebalancing	20%-Divergence Rebalancing
$lnValueSP_h$	.002 (.002)	.003* (.002)	.004 (.002)	.003 (.002)	.002 (.002)
$AboveAverageRisk_h$	.009 (.007)	.008 (.007)	.013 (.010)	.012 (.008)	.007 (.006)
$NoRisk_h$	-.012*** (.004)	-.013*** (.003)	-.018*** (.005)	-.014*** (.004)	-.011*** (.003)
Age_h	.001 (.001)	.001 (.001)	.001 (.001)	.001 (.001)	.001 (.001)
$Age^2{}_h$	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
$Female_h$	.000 (.003)	.000 (.003)	-.002 (.005)	-.001 (.004)	.000 (.003)
$lnTWealth_h$	.000 (.002)	.000 (.002)	.000 (.002)	.000 (.002)	.000 (.001)
$lnIncome_h$	-.002 (.003)	-.002 (.003)	-.003 (.005)	-.002 (.004)	-.001 (.003)
$Child_h$	.003 (.005)	.002 (.005)	.006 (.007)	.004 (.006)	.002 (.004)
β_0	-.053* (.028)	-.041 (.026)	-.065* (.038)	-.061* (.032)	-.051** (.025)
R^2	.074	.084	.085	.075	.076
R^2 adj.	.049	.060	.061	.050	.052
F-Test	3.019	3.482	3.524	3.057	3.123