

The psychology of diversification:
Novice investors' ability to spread risks

Ted Martin Hedesström



Department of Psychology, Göteborg University
Gothenburg, Sweden, 2006

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Printed in Sweden
Vasastadens Bokbinderi AB
Göteborg 2006
ISSN 1101-718X
ISRN GU/PSYK/AVH--171--SE
ISBN 91-631-8556-3

To Kerstin

Abstract

Hedesström, T. M. (2006). *The psychology of diversification: Novice investors' ability to spread risks*. Department of Psychology, Göteborg University, Sweden

In order to reduce risk, portfolio theory prescribes holding a stock portfolio that is diversified across industries and countries. This thesis investigates novice investors' ability to compile well-diversified portfolios and to what extent psychological factors may affect diversification. In Study I a sample of 10,999 randomly selected citizens' choices of mutual funds in the Swedish public premium pension scheme (PPS) was analysed. Among those who did not choose the default fund it was typical to include as many funds as were allowed (five) in a portfolio and to use a $1/n$ heuristic, allocating investments evenly across the selected funds. While thus superficially well-diversified, portfolios were often home biased (overrepresentation of Swedish funds) and possibly influenced by extremeness aversion (overrepresentation of medium-risk funds). Study II replicated these findings in an Internet-survey where 392 university employees made a fictitious choice of PPS funds. Highly involved individuals included a larger number of funds in their portfolio but were not less home biased. Suggesting that investment experience does not improve diversification, individuals who own stock (outside the PPS) were not less home biased. In Study III undergraduates made hypothetical investments, choosing between stock funds that were stripped of all characteristics except for their past (Experiment 1) or expected (Experiments 1 and 2) returns. In Experiment 1 ($N = 40$) participants paid more attention to the volatility of individual funds than to the volatility of aggregated portfolios. In Experiment 2 ($N = 46$) a majority diversified even when this *increased* risk due to covariation between individual funds' returns. In Experiment 3 ($N = 48$) nearly half of those who seemingly attempted to minimize risk diversified even when this increased risk. These results suggest that novice investors neglect covariation when diversifying across investment alternatives. Study IV replicated and modified Experiment 2 in Study III. Undergraduates ($N = 160$) were randomly assigned to one of five conditions with varying instructions. Being instructed to minimize risk, many diversified even when this increased risk. Choices were not markedly improved by informing participants of how covariation affects portfolio risk. Only when being instructed to systematically calculate the returns of diversified portfolios, was covariation neglect reduced. In sum, the results of Studies I-IV suggest that novice investors have an insufficient understanding of what portfolio diversification is essentially about: combining assets which returns are not likely to covary. The results hint at a deep-rooted inability to grasp the concept of covariation, possibly hampering acquisition of adequate knowledge. It is hypothesized that naïve heuristic diversification may be a residual of a default cognitive strategy to seek variety for the sake of learning about the environment.

Keywords: Covariation neglect, Novice investors, Portfolio diversification, Diversification heuristic, Behavioural economics

Ted Martin Hedesström, Department of Psychology, Göteborg University, Box 500, SE 405 30 Gothenburg, Sweden. Phone (voice): +46 31 773 4284, (fax): +46 31 773 4628, E-mail: ted.hedesstrom@psy.gu.se

Acknowledgements

I thank everyone who has contributed to the completion of this thesis. Professor Tommy Gärling, my supervisor, who always gave me a lot of his time and would rate highly on any involvement scale. Dr Henrik Svedsäter, initiator of ideas and a great collaborator. Professor Anders Biel, Docent Niklas Karlsson, Dr Erik Lidén, and Professor Henry Montgomery, who at various stages of this work have provided valuable input. Lic Karl Ask and Dr Peter Loukopoulos, (positive) outliers in the area of helpfulness. Lic Lars Olsson, a fabulous roomy (and a great competitor in the penguin game). Lic Andreas Nilsson, loyal companion through Kafkaesque experiences. Dr Lisbeth Hedelin, who supervised my undergraduate dissertation twelve years ago and who has encouraged and supported me ever since. Karl Gillholm, who has made a fine art of collecting data. Many others in the Department of Psychology at Göteborg University deserve my deepest gratitude, for great comradeship as well as for help with practical matters. Finally, I am grateful to Kerstin for her love and patience, and to my parents, my sister, and my friends outside academia, who have supported me throughout.

This research was financially supported by grant K2001-0306 to Tommy Gärling from the Bank of Sweden Tercentary Foundation, by grants to the Center for Consumer Research, Göteborg University and Chalmers University of Technology, and by grants to me from the Adlerbert Grant Foundation, the Paul and Marie Berghaus Donation Fund, the Kungliga och Hwitfeldtska Foundation, and the Jane Beattie Memorial Fund.

Gothenburg, February 2006

Ted Martin Hedesström

Preface

The thesis consists of this summary and the following four studies referred to in the text by their Roman numerals:

- I. Hedesström, T. M., Svedsäter, H., & Gärling, T. (2004). Identifying heuristic choice rules in the Swedish Premium Pension Scheme. *Journal of Behavioral Finance*, 5, 32-42.
- II. Hedesström, T. M., Svedsäter, H., & Gärling, T. (2006). *Determinants of the use of heuristic choice rules in the Swedish Premium Pension Scheme: An Internet survey*. Unpublished manuscript.
- III. Hedesström, T. M., Svedsäter, H., & Gärling, T. (2006). *Covariation neglect among novice investors (I)*. Unpublished manuscript.
- IV. Hedesström, T. M. (2006). *Covariation neglect among novice investors (II)*. Unpublished manuscript.

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Introduction

Paraphrasing the saying “don’t put all your eggs in one basket,” portfolio theory (Levy & Sarnat, 1970; Markowitz, 1952) prescribes holding a stock portfolio that is diversified across different industries and countries. The reason is that it is more likely for firms within the same industry (country) to do poorly at the same time than for firms in dissimilar industries (countries). The idea of diversification has been acknowledged as one of the most fundamental theoretical insights in financial economics (Boyle, Uppal, & Wang, 2003). Yet, investors tend to diversify insufficiently. Illustrative of this, portfolios are often dominated by stocks in one’s home country (French & Poterba, 1991; Grubel, 1968; Solnik, 1974), stocks in the employer’s company (Benartzi, 2001; Huberman & Sengmuller, 2004; Liang & Weisbenner, 2002), or stocks in companies that are located close to home (Grinblatt & Keloharju, 2001; Huberman, 2001).

The topic of this thesis is the psychology of diversification. The work is related to the expanding body of behavioural finance literature investigating links between psychology and economics (Mullinathan & Thaler, 2001). The specific question addressed here is how able novice investors are to diversify effectively, and what psychological factors affect this ability. The general public is increasingly making stock market investment decisions, foremost as a consequence of the worldwide trend towards making people manage their own retirement savings (Benartzi & Thaler, 2002). In the U.S., employer-sponsored pension plans are offering larger and larger sets of options from which employees can form their own investment portfolios (Iyengar & Jiang, 2003), and national governments are considering the possibility of allowing citizens to manage their own public retirement savings in a similar way (Bailey, Nofsinger, & O’Neill, 2003; Börsch-Supan & Wilke, 2003). In Sweden this has already happened. At the introduction of the premium pension scheme (PPS) in 2000, all income earners received a brochure in the mail containing descriptions of 455¹ mutual funds consisting to varying degrees of stocks and interest-bearing securities, and were encouraged to select one to five funds into which part of their public retirement savings would be invested.

As a starting point for our investigation into novice investors’ ability to spread risks, the first empirical study presented in this thesis examines people’s choices of mutual funds in the PPS. On the basis of this analysis we then move on to experimental research. Before summarizing and discussing those studies, the next section provides an overview of how psychology’s view on preference and choice differs from the one implied in economic theory. It is followed by a literature review of psychological factors that may affect diversification.

¹ In 2005 the number of funds had increased to 689 (PPM, 2006).

Psychology's View on Preference and Choice

Expected utility theory (von Neumann & Morgenstern, 1947) provides the foundation of standard economic models of how people make choices. Implicit in this theory is the assumption that individuals have stable and coherent preferences; they know what they want and their preference for a particular option does not depend on the context. Individuals who face a choice will go through all available alternatives before selecting the one that they judge to be the best. However, in psychology there is a growing consensus that people's preferences are constructed (Ariely, Loewenstein, & Prelec, 2003; Hoeffler & Ariely, 1999; Slovic, 1995). In many situations, people do not know what they want before being presented with the choice alternatives. Preferences for individual alternatives are being formed in the process of making the decision and are thus dependent on how the choice problem is described or "framed" (Kahneman & Tversky, 1984), and on the method used when searching among options. Instead of evaluating all available alternatives, people use simplifying heuristics that limit the search. As humans' cognitive processing capacity is limited (e.g., Simon, 1955), this is especially likely in complex and unfamiliar choice tasks. Examples of heuristics are the recognition heuristic (Goldstein & Gigerenzer, 1999), implying that something well-known (recognized) is automatically believed to be bigger, better, or safer than something unknown; and the affect heuristic (Slovic, Fihucane, Peters, & MacGregor, 2002), referring to people's tendency to regard objects and activities with positive connotations as probably yielding better outcomes than those with negative connotations. Basing judgement on data that is processed according to heuristics reduces effort and is generally quite useful, but can sometimes lead to biases, that is, systematic errors of judgement (see, e.g., Gigerenzer, Todd, & the ABC Research Group, 1999; Tversky & Kahneman, 1974). Evidence suggests that heuristics are used by experts and novices alike (Dawes, 1997; Wärneryd, 2001). However, what kind of heuristic people use is often the result of a trade-off between effort and accuracy (Payne, Bettman, & Johnson, 1993), and high involvement (perceived personal relevance, based on inherent needs, values, and interests, see Zaichkowsky, 1985) in a decision task may make people use more sophisticated decision processes (Chaiken, Liberman, & Eagly, 1989; Mittal, 1988; Petty & Cacioppo, 1986; Verplanken & Svenson, 1997).

Criticism has emerged of the way judgement and decision making researchers have piled up an increasing number of heuristics and biases without being able to integrate them into a coherent theoretical framework (see, e.g., Gigerenzer et al., 1999). In response to this, Kahneman (2003) proposed in his Nobel Prize speech a two-system framework, distinguishing between two different modes of cognitive processing, based on the notion that some thoughts are more accessible (come to mind more easily) than others. While System 1 processing (intuition) is typically fast, automatic, effortless, and associative,

System 2 processing (reasoning) is slower, serial, effortful, and deliberate. Similar dual-process models of cognition have been proposed previously (see Chaiken & Trope, 1999, for a review), but Kahneman's framework specifically addresses the question of heuristics and biases. In this framework, heuristics are categorized as System 1 processing, and an intuitive judgement that is a product of System 1 processing will be modified or overridden if System 2 identifies it as biased. In the two-system framework, heuristics is defined as attribute substitution (a target attribute of a judgement object is substituted by a related heuristic attribute that comes more readily to mind, see Kahneman & Frederick, 2002), which implies a departure from the general conception of heuristics, at various times referring to principles, processes, or sources of cues for judgement (Tversky & Kahneman, 1974). Keren and Teigen (2005) point out that this conceptual vagueness has given rise to confusion regarding whether the term heuristics refers only to sub-conscious processes or also includes more deliberate choice strategies (see also Gilovich & Griffin, 2002). They conclude that while current views seem to suggest that the mechanisms underlying heuristics are essentially automatic and are operating outside the individual's awareness, it is questionable whether an all-inclusive theory of heuristics and biases is feasible, as the various heuristics are based on a wide range of perceptual and cognitive mechanisms that are only partially linked.

The following sections present some heuristics and biases of particular relevance for portfolio diversification.

Diversification Heuristics

Experimental research has shown that when people are asked to choose many items at the same time, they commonly apply a diversification heuristic, leading to greater variety than if the items were to have been chosen one at a time (Ratner, Kahn, & Kahneman, 1999; Read & Loewenstein, 1995; Read, Loewenstein, & Kalyanaraman, 1999). This has also been shown outside the laboratory. For example, Simonson and Winer (1992) found that for a family who purchase a given number of yoghurt cartons, the amount of variety in flavors was greater if they were purchased all at once than in several separate shopping trips. It has been suggested that people seek variety because they are risk averse and uncertain about their future preferences (Kahn & Lehmann, 1991; Simonson, 1990). Thus, they select a bundle of items that is unlikely to have the lowest utility instead of the items that potentially have the highest utility. Experiments with snacks and lottery tickets have demonstrated that the use of a variety-inducing diversification heuristic sometimes leads to biased choice (too much diversity). The notion of a diversification bias is however not directly transferable to an investment context, where the tendency to choose great variety might on the contrary be beneficial and result in diversified investments (Read, Antonides, van den Ouden, & Trienekens, 2001). Nevertheless, as shown by

Benartzi and Thaler (2001), heuristic variety-seeking makes investors susceptible to framing effects. In analysing U.S. employee retirement schemes, they showed that participants tended to use a $1/n$ heuristic, simply dividing their contributions evenly among all the investment alternatives offered to them. In schemes offering a majority of stock funds most contributions were therefore invested in stocks, while in schemes offering a majority of interest funds most were invested in interest-bearing securities. Allocations were thus to a large extent decided by how the choice was presented (framed) rather than representing a true reflection of investors' expectations of risk and return.² Use of the $1/n$ heuristic may hence reflect naïve diversification.

Benartzi's and Thaler's finding can be viewed as only one example of a more universal behavioural phenomenon. Reviewing studies covering a wide range of domains (decision analysis, managerial decision making, consumer choice), Fox, Bardolet, and Lieb (2005) conclude that people who allocate scarce resources among a fixed set of options tend to invoke "maximum entropy" heuristics by which they distribute the resource evenly across all options, adjusting (often insufficiently) according to their beliefs. In a series of experiments, Fox, Ratner, and Lieb (in press) demonstrated how allocations as a consequence vary systematically with what partition between options (or sets of options) happens to be most salient to the decision maker. They also showed that when judging probabilities, and when choosing consumer goods, high levels of expertise, motivation, or confidence in one's ability moderates the extent to which people rely on naïve diversification and therefore exhibit partition dependence (see also Fox & Clemen, 2005). However, Langer and Fox (2005) found no effect of self-rated knowledge on naïve diversification in a portfolio diversification task, and conclude that further research is warranted on what type of knowledge or information would inoculate investors against naïve diversification.

Familiarity Biases

Despite the benefits of diversifying stock portfolios internationally (Levy & Sarnat, 1970), portfolios are often tilted towards stocks from the investor's home country (French & Poterba, 1991; Grubel, 1968; Solnik, 1974). Several explanations for this concentration to domestic stocks have been proposed, such

² It should be noted that the pension schemes investigated by Benartzi and Thaler (2001) typically offered only few funds to choose from. Huberman and Jiang (2004) showed that a similar framing effect is not found in schemes offering more than ten funds, as people then cannot reasonably include all of them in a portfolio. Huberman's and Jiang's study confirmed, however, that people tend to use what they call the "more basic version" of the $1/n$ heuristic, dividing investments evenly across chosen funds. This is the use of the term adopted in Studies I and II in this thesis.

as high transaction costs associated with trading foreign securities, various barriers to international investment, home assets providing better hedges against home country-specific risks such as inflation, and information asymmetry between domestic and foreign investors (see Lewis, 1999, and Karolyi & Stulz, 2003, for reviews). Since these possible economic reasons do not justify the magnitude of the observed home bias, the explanation may be psychological. It has been suggested that the home bias is a consequence of the use of a home-country heuristic, and it might also be attributable to the recognition and affect heuristics described earlier. Regardless of which particular heuristic cognitive processes that might be involved, the home bias may be viewed simply as a familiarity bias, caused by intuitive cognitive (System 1) mechanisms. It is well-documented that people feel more optimistic about things with which they are familiar (Huberman, 2001). Football fans are overly optimistic when forecasting the results of their favourite team, and voters are overly optimistic about how their party will fare in upcoming elections (Babad, 1995; Babad & Yosi, 1991; Bar-Hillel & Budescu, 1995). This may be attributed to wishful thinking. However, simply having (or considering oneself to have) more knowledge about something may also lead to higher expectancies. Kilka and Weber (1997) showed that German business students felt more competent in judging domestic stocks than judging American stocks and that they, as a consequence, expected German stocks to give higher returns at a lower risk than American stocks. For American business students the pattern was reversed. Optimistic expectations with what is familiar may also explain why people often own (too much) stock in the company where they are employed (Benartzi, 2001; Liang & Weisbenner, 2002; Huberman & Sengmuller, 2004) or in companies that are located close to one's home (Grinblatt & Keloharju, 2001; Huberman, 2001).

The reason why it is not a good idea to hold too much stock in one country has, in essence, to do with correlation between returns. Diversification only reduces portfolio risk (variance) effectively if the returns of the included assets do not covary excessively (Levy & Sarnat, 1970).³ As returns of stocks within a particular country tend to covary more than equivalent stocks from different countries, effective risk reduction is best achieved by diversifying across countries. The home bias thus implies that investors neglect the portfolio's covariance structure in favor of other (perhaps psychologically founded) concerns, and raises questions about how well people understand the concept of covariation. Next follows a review of psychological research into how people perceive and respond to covariation.

³ Covariation, or covariance, and correlation are equivalent terms. In this context, to say that returns covary is equal to saying that they are positively correlated. If returns are negatively correlated, or uncorrelated, they do not covary.

The Human Capacity to Assess Covariation

The capacity to assess covariation has long been a topic of interest in the area of judgement and decision making. The vast majority of this research has employed dichotomous variables presented in two by two contingency tables. Typically, these tables summarize the number of instances of the presence and absence of variable X (e.g., a particular disease) purportedly associated with the presence and absence of variable Y (e.g., a particular symptom) (Jennings, Amabile, & Ross, 1982), and people are asked to estimate how these variables are related. Consistent findings from such studies are that (a) subjects act naïvely when computing covariation, often using data from only one or two cells of the contingency table (Arkes & Harkness, 1983), and (b) judgements of covariation are strongly influenced by prior beliefs, in some cases resulting in a virtually complete lack of sensitivity to the data (Nisbett & Ross, 1980, cited by Broniarczyk & Alba, 1994). See Shanks (2004) for a comprehensive review.

However, covariation between stock returns is between continuous variables and not between dichotomous variables. Comparatively little experimental attention has been directed towards people's ability to assess covariation between continuous variables. In the few published studies that exist, participants are typically presented with columns of data and asked either to estimate how these variables are related or to predict one variable from another. In a series of experiments, Jennings et al. (1982) showed that individuals tend to underestimate low correlations between variables, and that they only detect very high correlations ($r > .8$) with certainty. They suggest that any organism—human or non-human—is likely to notice only those covariations that its own history, or the history of its species, predisposes it to see and that this might explain the poor performance. Well, Boyce, Morris, Shinjo, and Chumbley (1988) found that while their participants made poor global judgements of strength of relationship, they were better at predicting one variable from another. Using a prediction task, Malmi (1986) found that participants responded adequately to positive correlations in the data but showed a virtual lack of sensitivity to negative correlations. Broniarczyk and Alba (1994) demonstrated that their participants tended to rely on prior beliefs of how variables are related, even in spite of overwhelming contradictory information in the data. Furthermore, they showed that prior beliefs had a greater impact on a prediction task than on a correlation estimation task.

Only few experimental studies link covariation assessments to portfolio diversification. Behavioural studies of portfolio diversification typically deal with how people divide money between stocks and interest-bearing securities (e.g., Bernarzi & Thaler, 2001; Langer & Fox, 2005) rather than with diversification between risky assets. An exception is Kroll, Levy, and Rapaport (1988), who presented three groups of undergraduates with the previous returns of three stocks, A, B, and C, asking them to form portfolios. For all three groups,

the returns of stocks A and B were uncorrelated, as were the returns of stocks A and C. While the returns of stocks B and C were uncorrelated for the first group, correlations between these stocks were positive ($r = .8$) for the second group and negative ($r = -.8$) for the third group. If covariance were taken into account, allocations to each of the stocks should differ between the groups. As the correlations were that strong, the question is perhaps not so much whether participants were able to detect the covariations, but rather whether they were able to assess how these covariations affect portfolio risk. As no significant differences between the groups were found, the authors concluded that the participants neglected covariance. When repeating the experiment with business students, subjecting them to a possible loss and offering them the possibility to copy each other's actions, participants did, however, respond to changes in the correlation coefficient (Kroll & Levy, 1992). Since it is not clear which changes in the experimental procedure caused the differences in results between these two studies, it is difficult to from them draw conclusions about whether (or to what extent) people's covariation assessment ability influences diversification. The empirical studies that are summarized in the following will address this issue further.

Summary of the Empirical Studies

Overview

The aim of this thesis is to investigate whether novice investors are able to diversify stock fund portfolios effectively, and what psychological factors might affect this ability. In Study I citizens' choices of funds in the Swedish premium pension scheme (PPS) are analysed with respect to various heuristic-driven biases. Results considered of particular relevance for the main research question of the thesis will be highlighted. In Study II these results are replicated in a more controlled setting (an Internet survey) where the role of involvement is explored. Studies III and IV are laboratory experiments, building on some of the findings from the previous studies.

Study I

The premium pension scheme (PPS) constitutes a part of the Swedish public pension system. At its introduction in 2000, all income earners received a brochure containing descriptions of 455 mutual funds, and were encouraged to select one to five funds into which part of their retirement savings would be invested. Citizens who in spite of a massive advertising campaign did not compile their own fund portfolio had their money automatically invested in a default stock fund. We analysed a randomly selected sample of 10,999 citizens' choices of PPS funds from the year 2000. The following results were obtained.

Almost one third of the sample (32.9%) chose to leave their money in the default fund. Although no objective comparable benchmark exists, this result is not inconsistent with the prevalence of a default bias (Johnson, Hershey, Meszaros, & Kuhnreuter, 1992), that is, an inflated preference for any option that is presented as a default. A logistic regression analysis revealed that individuals' propensity to choose the default fund was decreased by having a larger amount to invest, by being young, and by being a woman.

The typical choice for those who did not choose the default fund was to include as many funds as were allowed (five) in the portfolio. Regardless of how many funds were chosen it was furthermore typical to select a set of funds that all belonged to different categories and were managed by different fund managers. This is consistent with the use of a variety-inducing diversification heuristic (Read & Loewenstein, 1995). A closer examination was conducted in order to assess whether individuals diversified naïvely across the four most salient subgroups of funds. Since a portfolio often included a stock fund, a mixed fund, and a lifecycle fund, but seldom also an interest fund, the results were inconclusive.

Funds with extremely high risk and funds with extremely low risk were chosen to a lesser extent than their relative availability in the total set of offered funds. People's choices were thus possibly influenced by extremeness aversion (Simonson & Tversky, 1992).

Whereas Swedish stocks only represents approximately one percent of the world market (Cronqvist & Thaler, 2004), 43 percent of people's choices of region-specific stock funds were of funds investing only in Sweden. Taken together with funds that hold at least half of their investments in Sweden, this figure increases to 62 percent. Furthermore, the proportion of choices of funds investing only or predominantly in Sweden was larger than the relative availability of such funds in the total set of funds. For all other region-specific stock funds, the relationship between available funds and choices of funds was the reverse. These results thus indicate a home bias (French & Poterba, 1991).

In accordance with the "basic version" (Huberman & Jiang, 2004) of the $1/n$ heuristic (Benartzi & Thaler, 2001), by far the most popular allocation among those who selected more than one fund was to divide the investment evenly across the chosen funds. This was the case regardless of how many funds were chosen, except that individuals selecting three funds could only approximate an even division.

In summary, people's choices indicated a home bias, extremeness aversion, and use of a $1/n$ heuristic. While not conclusive, the results are not inconsistent with the prevalence of a default bias and with the use of a diversification heuristic. Of particular relevance for the main research question of this thesis is that (i) people typically included as many funds as were allowed (five) in the portfolio and (ii) the indication of a home bias. This suggests the prevalence of naïve diversification.

Study II

The aims of Study II were twofold. Firstly, as heuristic-driven biases may depend on the complexity of the choice task (Payne et al., 1993), we wanted to investigate whether the results from Study I would be replicated when the choice task was simplified. A second aim was to disentangle possible individual determinants of the use of a default option heuristic, a diversification heuristic, a home country heuristic, and a $1/n$ heuristic. A particular focus was on the role of involvement, since highly involved individuals may use more sophisticated decision processes (Verplanken & Svenson, 1997).

A sample of 392 employees at Göteborg University from all levels and areas of duty completed an Internet survey. They were asked to make a fictitious choice of PPS funds as if made for the first time. The same fund categories as in the PPS were presented. However, instead of choosing between hundreds of funds, respondents made a choice among *categories* of funds presented on a single page. They selected between one and five unspecified funds in each chosen category. Information about sociodemographics, savings, and level of involvement in the real-world PPS choice was obtained and included in a series of regression analyses. Level of involvement was measured on three self-report rating scales (not important—important; requires no deliberation—requires deliberation; nothing to lose—much to lose) that were averaged ($\alpha = .734$).

Having a larger amount to invest, owning stocks, being a woman, and being younger showed independent effects of increasing involvement.

Being more involved, having a larger amount to invest, and owning stocks (i.e., having stock market investment experience) moderated the tendency to choose the default fund. The effects of involvement, amount to invest, and stock ownership on choices of the default fund was shown not to mediate effects of other variables. These results are in line with the hypothesis that less involved individuals are more likely to rely on a default option heuristic by which a default alternative automatically is being considered more desirable than if it were not presented as a default (Johnson et al., 1992). However, the fact that choice of the default fund was more frequent than in Study I (55.6% vs. 32.9%) might also be attributable to the relatively well-known fact that the default fund since the launch of the PPS had performed better than the average self-compiled portfolio.

Consistent with the use of a variety-inducing diversification heuristic, the typical choice among respondents who did not choose the default fund was to include as many funds as were allowed (five) in the portfolio, all of which belonging to different categories. More highly involved and younger individuals included a larger number of funds in their portfolio than others, and the effects of involvement and age on the number of chosen funds were shown not to mediate effects of other variables. These results apparently contradict the notion of a causal relationship between low involvement and the use of heuristics. Possibly,

the diversification heuristic differs from the other investigated heuristics, being a deliberate choice strategy rather than a result of automatic cognitive processes. It is however also conceivable that the simultaneous choice frame (Read & Loewenstein, 1995) indeed evokes a first impulse to seek variety, but that the choice strategy associated with this impulse may or may not be carried out depending on how much effort one is willing to make, as it can be more effortful to choose many funds than few. If diversification is prompted by an impulse to seek variety rather than based on sufficient knowledge, effective diversification is unlikely. The fact that portfolios were generally tilted towards domestic stock—and no less so for those who included many funds in their portfolio—indicates that many failed to diversify effectively. Of all investments made in region-specific funds, 39.5 percent was invested in Swedish stocks, suggesting a home bias. Neither involvement nor any of the background variables were found to affect the proportion of Swedish stock funds included in the portfolio, or to affect equal investment allocation across chosen funds (the typical allocation). Thus, no evidence for a causal relationship between low involvement and the use of a home country heuristic or a $1/n$ heuristic was found.

To summarize, although the choice task was simplified compared to Study I, indications of the use of heuristic choice rules were not reduced. We found no evidence for a causal relationship between low involvement and the use of heuristics. While more highly involved individuals compiled superficially better-diversified portfolios than others, as they typically included a larger number of funds, they were not less home biased. People who own stock (outside the PPS) were not less home biased than others, suggesting that having stock market investment experience does not improve diversification. In order to promote effective diversification, thorough educational effort or decision support is warranted.

Study III

In order to investigate diversification in a controlled setting, Study III consists of three laboratory experiments. The participants were undergraduates at Göteborg University, recruited either in psychology classes or from a pool of students enrolled in different programs volunteering to take part in experiments. Participants made hypothetical choices of stock funds that were stripped of all characteristics except for their returns. In all experiments, participants were to invest SEK 10,000 (about U.S. \$1,250) for a period of ten years.

In Experiment 1 participants ($N = 40$) could choose one of two portfolios (A or B), each consisting of two stock funds. In one within-groups condition the returns of each of the four preceding years were displayed at portfolio level, whereas in another within-groups condition the returns were displayed at fund level. When past returns were displayed at portfolio level, Portfolio B constituted the least risky alternative, since its returns fluctuated less over the four-year

period. When past returns were displayed at fund level, it was less transparent which of the portfolios was the least risky. The returns of the funds included in Portfolio A fluctuated less but were positively correlated. The returns of the funds included in Portfolio B fluctuated more but were negatively correlated. When returns were displayed at the portfolio level, a majority chose Portfolio B, indicating that they strived to minimize the risk of their investment. However, when returns were displayed at the fund level, a majority instead chose Portfolio A. Assuming that these participants also strived to minimize risk, this indicates that they downplayed the role of covariation, instead viewing the volatility of the individual funds as the main indicator of portfolio risk.

In Experiment 2 participants ($N = 46$) could invest the whole amount in a low-risk fund or in a high-risk fund, or divide it evenly between the two funds (i.e., diversify). A table displayed five future scenarios, each of which was equally likely to occur. These scenarios showed the possible returns after the ten-year period if investing in the low-risk fund and if investing in the high-risk fund. The distribution of returns if diversifying between the two funds was not displayed, but could be inferred from this information. In one within-groups condition the two funds' returns were negatively correlated. Diversifying would thus imply the least disparate distribution of returns, and therefore the lowest risk. In another within-groups condition the two funds' returns were positively correlated. Investing only in the low-risk fund would imply the least disparate distribution of returns and was therefore the least risky alternative. Indicating naïve diversification due to covariation neglect, the results showed a higher frequency of choices of the combination of the two funds when this constituted the least risky alternative (i.e., in the negative correlation condition) than choices of the single low-risk fund when this constituted the least risky alternative (i.e., in the positive correlation condition). A large proportion of the participants diversified in both conditions, but only few chose the least risky alternative in both conditions. While both of these groups of participants seemingly attempted to minimize risk, the former diversified naïvely, neglecting covariation between the funds' returns.

Experiment 3 was similar to Experiment 2, but the participants ($N = 48$) could now invest the whole amount in Fund A or in Portfolio A + B, the latter consisting in equal parts of Fund A and Fund B. Five scenarios of equal probability displayed possible future returns after the ten-year period for each of these two investment alternatives. In one within-groups condition the distribution of returns was more disparate for Fund A than for Portfolio A + B, implying that the returns of Fund A and Fund B were negatively correlated. Portfolio A + B thus constituted the least risky alternative. Conversely, in another within-groups condition the distribution of returns was more disparate for Portfolio A + B than for Fund A, implying that the returns of Fund A and Fund B were positively correlated. Fund A thus constituted the least risky alternative. Indicating naïve diversification due to covariation neglect, the results showed a higher frequency

of choices of Portfolio A + B when this constituted the least risky alternative (i.e., in the negative correlation condition) than choices of Fund A when this constituted the least risky alternative (i.e., in the positive correlation condition). Almost half of those who seemingly attempted to minimize risk diversified even when diversifying in fact, due to covariation between the individual funds' returns, increased risk compared to not diversifying.

Together these experiments indicate that novice investors to a large extent lack sufficient understanding of the rationale behind diversification. Instead, they diversify heuristically, neglecting how covariation between the returns of individual assets affects portfolio risk. It is concluded that naïve diversification is likely to be a consequence of (i) previous advice, (ii) a cognitive bias to seek variety, or (iii) a combination of these factors.

Study IV

Although the experiments in Study III thus demonstrated novice investors' covariation neglect, its determinants remain unclear. Study IV was aimed at providing insights into the processes underlying naïve diversification and covariation neglect. The procedure was similar to Experiment 2 in Study III. The participants were undergraduates at Göteborg University, recruited from a pool of students enrolled in different programs volunteering to take part in experiments. Participants ($N = 160$) made hypothetical choices to invest SEK 10,000 in stock funds for a period of ten years. They could invest the whole amount in a low-risk fund or in a high-risk fund, or they could divide the amount evenly between the two funds (i.e., diversify). A table displayed five future scenarios of equal probability. These scenarios showed the possible returns after the ten-year period if investing in the low-risk fund, and the possible returns if investing in the high-risk fund. The distribution of returns if diversifying between the two funds was not displayed (except for in the distribution judgement condition, see below), but could be inferred from this information. Each participant performed two choice tasks. In one task, the two funds' returns were negatively correlated. Diversifying would thus imply the least disparate distribution of returns, and therefore the lowest risk. In the other task, the two funds' returns were positively correlated. Investing only in the low-risk fund would imply the least disparate distribution of returns, and was therefore the least risky alternative. Covariation neglect could be exhibited in one of two ways: either by choosing the low-risk fund in both tasks (naïve low-risk fund choice), or by diversifying in both tasks (naïve diversification). Both of these investment strategies represent naïve attempts to minimize risk. Participants who diversify in the negative correlation task *and* choose the low-risk fund in the positive correlation task are effective risk minimizers, as they consistently choose the alternative with the least disparate distribution of returns. Degree of covariation

neglect in each experimental condition was thus defined as the ratio between effective and naïve risk minimizers.

Participants were randomly assigned to one of five between-groups conditions. The *free choice condition* was identical to Experiment 2 in Study III. The results were replicated, showing a higher frequency of choices of a combination of the two funds when this constituted the least risky alternative than choices of the low-risk fund when this constituted the least risky alternative, thus indicating naïve diversification. In the *risk minimization condition* participants were explicitly instructed to minimize the risk of their investment. Compared to the free choice condition, the degree of covariation neglect was not significantly affected. The level of naïve diversification was unchanged, while both effective risk minimization and naïve low-risk fund choice increased. In the *covariation instruction condition* participants were again instructed to minimize risk. In addition, brief information about how covariation affects portfolio risk was provided. Compared to the risk minimization condition, the degree of covariation neglect was not significantly affected. Naïve diversification decreased, but naïve low-risk fund choice was unchanged. In the *calculation task condition* participants (again being instructed to minimize risk) were asked to calculate the returns of the diversified portfolio for each scenario. Thereafter, they made their investment choice. Compared to the risk minimization condition, covariation neglect was significantly diminished. Effective risk minimization increased, while both naïve low-risk fund choice and naïve diversification decreased. Most participants (82.9%) performed the calculations correctly. The *distribution judgement condition* was identical to the calculation task condition, but instead of instructing the participants to calculate the returns for the diversified portfolio, these returns were already given. The results were similar to the calculation task condition.

To summarize, many participants neglected covariation when attempting to minimize risk. Unable to make an intuitive judgement of how covariation affects portfolio risk, and unaware of what calculations were required in order to make a more systematic judgement, many participants resorted to naïve heuristic diversification. Providing information about how covariation affects portfolio risk reduced naïve diversification, but choices were not significantly better as a result, as covariation was still neglected. Only by instructing participants to calculate the returns of the combined portfolio, was covariation neglect reduced. The results support the conclusion drawn in Study III that novice investors lack sufficient insight into the rationale behind diversification. Naïve diversification could either be attributed to a (reasonable) preconception that diversifying always is safer than not diversifying, or to an intuitive propensity to allocate resources equally between all available options, a phenomenon known from many areas of decision making (Fox et al., 2005). In an investment context, naïve diversification may be better than no diversification. Care must be taken not to discourage naïve diversification without helping investors to make better choices.

Conclusion and Discussion

The fact that the typical choice in the PPS (among those who did not select the default fund) was to include as many funds as were allowed (five) in the portfolio may seem surprising, as investors generally do not diversify enough. However, this finding is consistent with previous research of novice investor behaviour indicating—at least superficially—substantial diversification. In analysing more than 600 U.S. employee pension plans, Huberman and Jiang (2004) noted that people tend to include several different funds in their portfolio, typically between three and four.

It might appear that those who include many funds in their portfolio simply follow advice or recommendations, reflecting portfolio theory. However, as sufficient diversification would be achieved by choosing only a single well-diversified stock fund, possibly combined with a non-risk fund, this extensive diversification across funds may on the contrary reflect insufficient knowledge, and be largely driven by psychological factors. As it is possible to select many alternatives at the same time, investing in the PPS is framed as a simultaneous choice. Automatic, intuitive “System 1” (Kahneman, 2003) cognitive mechanisms may therefore evoke a variety-inducing diversification heuristic (Read & Loewenstein, 1995). Investors’ intuitive search for variety may in this context be self-defeating. The fact that funds sometimes were combined in a manner that did not make sense (e.g., a lifecycle fund together with other types of funds) and that portfolios tended to be tilted towards Swedish stocks seems to indicate the use of a naïve diversification heuristic, implying the inclusion of many funds in the portfolio without consideration of how the returns of these funds are likely to covary. Combining a naïve diversification heuristic (“choose many funds”) with other heuristics (e.g., recognition or affect heuristics) may then create a superficially well-diversified portfolio that is in fact riskier than the investor intends. This would be in line with previous research showing that novice investors often fail to compile portfolios that match their expectations of risk and return (Benartzi & Thaler, 2002).

Including many funds in the portfolio might however not necessarily reflect an attempt to reduce the investment’s risk. Some may try to pick as many “winners” as possible. This is likely to indicate overconfidence, as no investor, regardless of experience, can hope to consistently “beat the market” (Shefrin, 2000). To illustrate, a stock fund that simply tracks the world index outperforms the average managed fund (where the fund manager tries to maximize returns by buying and selling stocks) in the long run (Carhart, 1997; Gruber, 1996; Jensen, 1969; Malkiel, 1995). Nevertheless, people may feel that they can afford to gamble with their (comparably modest) PPS money, especially if they have enough pension savings elsewhere. A reason to abstain from diversifying internationally may furthermore be a desire to promote domestic growth rather than getting the highest possible pension, and it is also possible (although

perhaps unlikely) that people choose Swedish assets in the PPS because they hold foreign assets in other types of savings, and thus strive to achieve a better-diversified total investment portfolio.

The degree to which a portfolio is diversified could hence be influenced by numerous factors, such as prior beliefs, advice, intuition, risk attitude, and preferences. In Studies III and IV novice investors' diversification decisions were examined without confounding influences from their preferences for particular industries or countries. The main result from these experimental studies is that when being instructed to minimize the risk of their investment, a large proportion of the participants diversified even when, due to covariation between the individual assets' returns, this actually implied a higher risk exposure than not diversifying. This suggests that (i) naïve diversification is driven by a desire to reduce risk, rather than reflecting overconfident investors' attempt to pick "winners," and that (ii) a large proportion of novice investors have an insufficient understanding of the fact that effective portfolio diversification requires that included assets must not be positively correlated.

Many of the participants in these experiments thus exhibited a poor intuitive judgement of how covariation affects portfolio risk, acting as if diversifying always is the safest option even when facing contradictory evidence in the data. Two alternative (but not mutually exclusive) explanations for this result might be suggested. One is that the naïve diversification exhibited in these experiments may be driven by a "cognitive instinct" (Fox et al., 2005) towards even allocation across all available alternatives, in accordance with the $1/n$ heuristic (Benartzi & Thaler, 2001) and other "maximum entropy" heuristics (Fox et al., 2005). Fox et al. (2005) note that this choice behaviour may reflect an intuitive application of Laplace's Law, which states that if there is not sufficient reason to prefer one hypothesis to others, the same probability should be attributed to all hypotheses (e.g., Laplace, 1776; cited in Hacking, 1975, p. 132). Furthermore, in many contexts people seek variety because it provides information that can help to inform future choices (Read & Loewenstein, 1995). As suggested by Rubenstein (2000), over-diversification in financial contexts may be a "residual" of this instinct to diversify for the sake of learning about the environment. That is, although it is unlikely that investors choose variety because they de facto want to try out different alternatives, evolution may have made diversification a default cognitive strategy that in many situations works well. In the same vein, Lo (2004) posits that sub-optimal behaviour and behavioural biases are not unlikely when heuristics are taken out of their evolutionary context. As the environment changes, heuristics of the old environment are not necessarily suited to the new.

Another explanation for the drive toward diversity exhibited in Studies III and IV is that the participants have taken onboard the main message from advice given on previous occasions by financial advisors, the press, and so forth: "it is good to diversify." However, they lack sufficient insight into the rationale underlying this advice and are therefore unable to discriminate between cases in

which it is strictly applicable and cases in which it is not. Regardless of which of these factors contributes the most to the tendency to “diversify no matter what,” the results hint at a deep-rooted inability to grasp the concept of covariation, a notion supported by psychological research into people’s ability to assess covariation (e.g., Shanks, 2004). Why it is so hard to judge how the relationship between individual assets’ returns affects portfolio risk remains unclear. This phenomenon may be attributable (or analogous) to people’s tendency to use different “mental accounts” for different decisions (Kahneman & Tversky, 1984; Thaler, 1999). People tend to judge losses and gains associated with a particular option in isolation, rather than as being part of a wider picture. As people thus usually make decisions piecemeal (Thaler, 1999), consideration of interactions between different options (which covariance is essentially about) may not come naturally.

It might be suggested that participants in Studies III and IV resorted to naïve diversification because they lacked sufficient involvement in the task, and that they would perform better if awarded financial reimbursement in accordance with their performance. Some factors speak against this suggestion. Firstly, as the undergraduates taking part in the experiments did not participate in return for course credits, and hardly simply for the money (they were paid a modest flat fee equivalent to U.S. \$7), it is reasonable to assume that participation mainly was prompted by intrinsic motivation, extending to a desire to perform as well as possible. Secondly, in reviewing psychological and economic experiments with no, low, or high performance-based financial incentives, Camerer and Hogarth (1999) found no replicated study that made rationality violations disappear purely by raising incentives. In tasks such as trading in markets, bargaining in games, and choosing among risky gambles, the overwhelming finding of the review was that increased incentives did not change average behaviour substantively (although response variance often decreased). Thirdly, the tasks in Studies III and IV were designed to be as simple and clear as possible, and should not require much effort if one possesses the critical understanding of the concept of covariation. We therefore believe that the naïve use of the $1/n$ heuristic in these experiments was due to insufficient understanding of covariation rather than to low involvement. When participants in Study IV were informed of under what circumstances diversification does or does not reduce risk, their choice behaviour changed and the use of the $1/n$ heuristic decreased. Thus, participants made an effort to make the best possible choice rather than routinely applying the $1/n$ heuristic. The fact that their investment choices were not markedly better as a result, still exhibiting covariance neglect, underlines the difficulty in understanding how covariation affects risk. Although the experimental settings in Studies III and IV differ from the real world, where a diversification decision most likely is “reason-based” (Shafir, Simonson, & Tversky, 1993) rather than based on judgements of specified distributions of returns, it is conceivable that novice investors’ poor understanding of covariation

makes them less susceptible to fully digesting advice on diversification. While acknowledging that investments should be spread across many assets, they may place insufficient weight on more detailed information about how effective diversification should best be achieved. Lacking an integral principle to guide their choice, novice investors may end up with only superficially well-diversified portfolios, consisting of heuristically picked funds.

It is thus plausible that the diversification decision is a product of a dynamic interplay between knowledge and intuition. While knowledge undoubtedly is key, it is less clear what role experience plays. One might think that investors with previous experience in the stock market make better choices. However, psychological biases are powerful, and largely resistant to experience. Even professional investors are home biased (Erlandzon, 2005; Schiller, Kon-Ya, & Tsutsui, 1990; Strong & Xu, 1999) and neglect covariation (Jorion, 1994). Equity markets are “noisy” which makes learning difficult, and investors often draw the wrong conclusions from previous experiences (Odean, 1999). Experienced investors are generally overconfident (e.g., Anderson, 2004; Barber & Odean, 2000; de Long, Schleifer, Summers, & Waldmann, 1991; Törngren & Montgomery, 2004), possibly as a consequence of attributing previous successes to their own skills and previous failures to factors outside their control (Hastorf, Schneider, & Polifka, 1970; Langer & Roth, 1975; Miller & Ross, 1975). Indicating that investment experience does not improve diversification, Study II showed that people who own stock (outside the PPS) were not less home biased than others. Alba and Hutchinson (1987) propose that consumer knowledge has two major components: familiarity, which is related to experience, and expertise, which is related to ability. Investigating factors affecting people’s choices of mutual funds, Mårtenson (2005) showed that a high level of involvement leads to more familiarity (i.e., experience with stock market-related products) and more willingness to take risks, but whether involvement also results in better investment choices is less clear. Although not conclusively, findings from Study II suggest that increased involvement has little or no impact on improving diversification. While more highly involved individuals compiled superficially better-diversified portfolios than others, as they typically selected a larger number of funds, they were not less home biased. As the default fund in the PPS was a well-diversified (global) fund, highly involved individuals may in fact have achieved a poorer diversification than those who left their money in the default fund as a consequence of low involvement. Thus, involvement (and experience) may be more related to overconfidence than to expertise.

To conclude, the studies presented in this thesis suggest that a large proportion of novice investors lack sufficient insight into the rationale underlying portfolio theory’s recommendation to diversify. Participants in the experiments tended to rely on a naïve diversification heuristic, in essence implying that *any* diversification reduces risk, thus substantiating the suspicion of Goetzmann and Kumar (2004) that novice investors incorrectly believe that any multiple-asset

portfolio, irrespective of its covariance structure, will be well-diversified. Markowitz (1952) noted that diversification should be of the “right kind” for the “right reason” (p. 89). The studies presented here suggest that many novice investors fail to diversify in accordance with these criteria. Fox et al. (2005) suggest that people become less susceptible to heuristic diversification as they become more knowledgeable. This is in line with Read and Loewenstein’s (1995) notion that variety seeking should decline if uncertainty is reduced, and it is also compatible with the two-system framework of cognitive processing (Kahneman, 2003), which postulates that an intuitive judgement that is a product of System 1 will be modified or overridden if System 2 identifies it as biased. However, acquisition of knowledge relevant for diversification may be hampered by people’s poor grasp of the concept of covariation. As De Bondt (1998, p. 836) states, “... that risk depends on covariation between returns remains foreign to many investors.” But while naïve diversification is undesirable, it may be better than *no* diversification. In order to improve the ability of novice investors to compile well-diversified portfolios, thorough educational effort is likely to be required. If the main message that effectively filters through is that diversifying will not always reduce risk, information could possibly do more harm than good. Many participants in the Internet survey (Study II) expressed a sense of helplessness with respect to choosing PPS funds and a general resentment towards “gambling” with their public retirement savings. Clearly, such concerns must be taken seriously. The difficulty of this choice seems to have finally dawned on the Swedish government, since the instructions initially given to PPM (the authority responsible for administrating the PPS) recently changed and no longer include persuading as many citizens as possible to compile their own portfolio instead of choosing the default fund. Novice investors’ poor grasp of the rationale behind portfolio diversification calls into question the common sense in leaving this investment decision to them.

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