

Short Essay

How Does Household Portfolio Diversification Vary with Financial Literacy and Financial Advice

Introduction

In the article *How Does Household Portfolio Diversification Vary with Financial Literacy and Financial Advice*, published by *The Journal of Finance* in April of 2015, the author Hans-Martin von Gaudecker analyses the impact of financial literacy and financial advice in the decision-making process of household investments. In this report, the approach, including empirical methods, and results of Gaudecker's paper are summarized and reviewed.

Summary

Gaudecker identified a gap in the empirical research on household investment and the importance of portfolio diversification. He says that there have been two strands of studies, one which uses administrative data which detailed diversification properties but lacks data on financial advice and financial literacy. The second strand has used household surveys which include the missing areas but the data is not enough for a quantitative analysis. The goal for Gaudecker was therefore to close the gap in the existing research by using data from a Dutch household survey, with relevant information including financial advice and financial literacy, and provide a quantitative assessment of portfolio diversification.

The data consists of 381 household observations who possess a total of 99 shares and 170 funds. Each asset is connected to its time series of returns so that the risk-return characteristics of the household portfolios can be estimated. Assuming that all assets follow CAPM, the household portfolios were plotted in the mean-standard deviation plane together with the efficient frontier and several observations can be made. For one thing, portfolios that only contain stocks perform the worst when comparing them to the efficient frontier, they are poorly diversified. Both mutual funds and a combination of both stocks and funds in a portfolio perform much better. However, the best alternative is to include a risk-free asset in the portfolio, putting them very close to the efficient frontier in the mean-standard deviation plot.

The deviation of the portfolios from the efficient frontier in the mean-standard deviation plane can be translated to measurement number. Gaudecker chooses to use return loss, deviation from the efficient frontier at a given level of risk, as his statistic of the loss in diversification. The return loss is a product of the *expected excess return on market*, *fraction in risky assets*, *beta coefficient*, and *diversification loss*. The return loss was divided into five quintiles and then the average value of each statistic was calculated. The study highlights that return losses are particularly severe for households carrying a portfolio driven by uncompensated risk-taking.

Gaudecker moves on to examine the sources of underdiversification, which he does by analyzing the inputs that may have an effect on investment outcomes. One of the inputs is what he calls *financial numeracy*, originating from answers to households' financial decisions, being the quantification of financial literacy. Other inputs are the household's primary source of financial advice, amount of financial assets, education, and age.

There is a summary of the average return loss for the primary source of advice and the financial numeracy split into two parts by its median. From these values, it could be concluded that individuals who have themselves as the primary source of advice and are in the lower half in financial numeracy, perform significantly worse than the other categories. Considering the expected return they lose approximately one percentage point per year compared to the efficient portfolio, which is twice as much as the rest of the categories.

Further, an OLS regression was made for the return loss on multiple covariates across different quintiles. The most important observation made was that households that had low financial numeracy, i.e. low financial literacy, and didn't use any advice had the worst outcome in return losses. In his discussion, he speculates about why this might be and comes to the conclusion that a probable reason is overconfidence. They overestimate their own financial abilities, which is shown in the data. Among those who rely on their own financial judgement with below-median financial numeracy skills, have the highest self-rated financial knowledge.

Gaudecker also comments on the hypothesis that portfolio distortions are due to superior information. While there is some support in the results for the idea for middle and upper-performing portfolios, it does not account for portfolios with the highest return loss. Therefore he finds it unlikely that the driving force behind portfolio decisions is superior information in this case, instead, it should be considered to be investment mistakes.

The results further showed that financial knowledge is less important than financial numeracy. Therefore improving financial knowledge alone would have limited impact. Gaudecker suggests that financial numeracy skills reflect a border cognitive ability, which in turn affects financial behavior, such as stock market participation. It is therefore considered important to target disadvantaged children and try to improve their cognitive skills to benefit financial decision-making in the long run.

Moving on, Gaudecker uses the data to investigate how professional financial advice affects investment outcomes. On average professional financial advice increases the portfolio fees by 30 bps, since advisers recommend portfolios with higher fees. Nevertheless, the findings suggest that the impact of professional advice is limited and the effects of underdiversification are much more substantial. In his discussion, Gaudecker therefore brings up academic advice to invest in low-fee funds since they often compete with financial assets recommended by professionals who do not offer consumer-adapted content.

Empirical methods

In the first part of the report, the author analyses properties of households' portfolios in different ways. Important to state before discussing methods used is what data was used in the methods. The main data used in the report is from CentERpanel. The CentERpanel is an online survey conducted on

Dutch households. This survey collected much data from households during many years which makes the data practical to use in empirical tests. Gaudecker used the data from the years 2005 and 2006 to have a larger sample size while still having the analysis be cross-sectional. Standard errors because of clustering were addressed and statistical software standard methods were used to adjust them. Some data was excluded from the analysis in the report due to different reasons. Households with insufficient information and the ones with too low amounts of financial assets were dropped.

To calculate the pricing of the assets in the report, International CAPM (ICAPM) was used. The assumption that the assets follow international CAPM was made because of the difficulty of estimating the expected return due to the inconsistent time periods of the time series. ICAPM is a version of CAPM used on international investments adding the risks associated with e.g. foreign exchange to a normal CAPM (Chen 2021). CAPM is a method used to explain the relation between systematic risk and expected return, based on many assumptions. The basic idea behind CAPM is that the only way to achieve more return is to take more risk. ICAPM has the same foundational idea but also includes the risks associated with exposure to foreign currencies. Before actually using ICAPM, Gaudecker removed 0.3% of the benchmark index as well as mutual funds' fees from the gross return. The excess returns over the risk-free rate were used as returns. In the report, equation 1 was used to calculate the expected return for the households on all the assets a , and the MSCI Europe Index was used to represent the efficient market portfolio.

$$r_{a,t}^e = \beta_a \cdot r_{b,t}^e + \varepsilon_{a,t} \quad \text{Equation 1}$$

To discuss the costs of underdiversifications the author used return loss as the measure because of its comprehensiveness. The return loss measures the difference between the household portfolio mean return and the maximum return if choosing a position on the efficient frontier, consistent with the level of risk, see equation 2. In this equation ω is the risky asset fraction and $(\frac{S_b - S_h}{S_h})$ is the diversification loss. An alternative to return loss, also discussed by the author was the relative Sharpe ratio but because, among other things, it doesn't depend on the risk-free rate, return loss was chosen instead (von Gaudecker 2015).

$$RL_h = \mu_b \cdot \omega_h \cdot \beta_h \cdot \left(\frac{S_b - S_h}{S_h}\right) \quad \text{Equation 2}$$

The Sharpe ratio for the MSCI Europe Index was calculated using equation 3. Then the return loss, risky asset share, beta coefficients, and diversification loss were all analyzed in different quantiles.

$$S_b = \frac{\mu_b}{\sigma_b} \quad \text{Equation 3}$$

Further Gaudecker made an approximation of the production function using equation 4. An estimation of this equation was done using both ordinary least squares (OLS) and quantile regression. Quantile regression was used due to the fact that most parts of the distribution had insignificantly low diversification losses. OLS is a method used to estimate unknown parameters in a linear model by finding the ones that give the least variance. Quantile regression is also a method to estimate

parameters and is better at handling outliers. This method also takes the relation between the parameters and the quantiles into account, and models based on that. (IBM 2024)

$$Y = X'b + u \quad \text{Equation 4}$$

Financial numeracy was one aspect used in the analysis and to produce a continuous index of this, factor analysis was used. Factor analysis is a statistical method used to construct factors from asset return data or other variables. This creates a smaller set of factors from a larger number of variables. The continuous index was then standardized to be zero-mean and have a variance of one.

Critical Review

In this critical review, the assumptions made, the implications of the results, weaknesses, and strengths are carefully considered. Understanding these limitations and strengths is essential for accurately interpreting the study's results and evaluating its implications for policy formulation as well as academic research. Therefore, this review aims to determine the impact the study should have on the research field and policy-making.

In the paper, Gaudecker makes a few assumptions that are important to consider when evaluating the relevance and implications of the study. As mentioned previously, it is assumed that assets are priced according to the ICAPM. It assumes that international capital markets are integrated and that unlimited lending and borrowing at the risk-free rate is possible. These assumptions are quite strong and since they cannot be achieved realistically, this needs to be considered when interpreting the results. Further, the MSCI Europe Index is used as an estimation of the market portfolio. While it may be a good proxy, it will still vary from the theoretical market portfolio. The risk-free rate is approximated from the one-month EURIBOR, which is a good proxy but will still differ from the theoretical value in the same way as the market portfolio.

Other assumptions that lead to weaknesses in the results is that the data does not include the portfolio turnover, so it is assumed to be the despite whether professional advice is acquired or not. When this varies it leads to different results. Further, the costs associated with portfolio turnover are not considered in the analysis. It is worth keeping in mind that the estimates presented in the study do not necessarily yield the causal effect of mandating advice as well. The analysis on professional advice is also primitive as portfolio rebalancing was not included in the data and two-thirds of the mutual fund data did not include information on if there was a sales commission.

The sample is limited to the Dutch population between 2005 and 2006. The paper was published in 2011. A lot has happened in the world since then, so it is not impossible that replicating the survey today would yield considerably different results. The respondents are said to be representative of the Dutch population in observable characteristics despite a quarter of the surveys being lost due to incomplete reports. The respondents were asked to report each item and its quantity in their portfolio. This is very beneficial for the quality of the results, as no assumptions of the asset class and covariances between item returns have to be made, but it creates a disparity in the time and effort needed to fill out the survey, as households with a more diverse portfolio will need to report more information, and are thus more likely to not bother to fill out the survey. A third of the respondents report ownership of risky financial assets. It is worth noting that some respondents were removed

from the sample as they did not hold enough assets to be considered, which is reasonable but decreases the study's representativeness of the population. Another aspect that could affect the sample is a distorted sense of self, as people may unconsciously think that they invest more independently than they actually do for example, which is always a problem with self-reported measurements. There is a risk that respondents may not take the survey seriously or will not bother to fill it out to their best ability as well.

Return loss is chosen as the main measurement of diversification losses because of its comprehensiveness. As can be seen in equation 2, the measurement only takes the risky asset fraction, beta value, diversification loss, and the excess mean return of the market portfolio into account, which means that changes in any other relevant factors for diversification losses will not be represented in the study. Financial literacy, quantified by the financial numeracy score, is based on a simple quiz. In these cases, there is always the risk that the respondents do not take it seriously or misinterpret the questions which could invoke doubts about the validity of the results. The reported assets were observed for 11 years on average in an interval spanning between 6 and 20 years. There is a considerable difference between the longest and shortest timespans which can lead to a varying degree of certainty between assets. Specific events that may or may not be included, for example, a financial crisis, could possibly have an effect that is only captured in certain cases.

The statistical significance can be observed through the R^2 -values. The adjusted R^2 -value for the OLS regression regarding contributors to return loss is 0.11. For the version with fees included in the return loss, it is 0.10. These values are quite low which indicates that the regression explains parts of the variation, but it is still far from optimal.

As Gaudecker states in the introduction, the results could have implications for the regulation of consumer financial products, the design of retirement savings plans, as well as the distribution of consumer well-being in general. Further, different conclusions could provoke different rationales among policymakers. The author raises the point that a regulator's strategy would be dependent on what assistance the underdiversified households have. This information could provide insight into the cause of the expertise being lost. If the households have professional help and their portfolios are underdiversified, this could be a structural problem among the advisors, and regulations may be beneficial.

In the analysis, other measures of diversification loss beyond return loss were considered as well. The same patterns were visible there; however, they were not always significant. It is a good sign that the same patterns were identified, but it raises a red flag that the significance depended on the diversification measure used. Despite this, the main identified effects are considered strong enough to drive average coefficients and stay robust when controlling with various covariates. The results are in line with previous analyses in administrative records, as well. This is especially meaningful as previously comprehensive and quantitatively vigorous portfolio diversification studies have only been done on Scandinavian countries, so this widens the research field and gives more international validity to the results. Previous studies have mainly focused on either detailed diversification properties from Scandinavian administrative data or simple measures of portfolio diversification based on household surveys internationally. This study combines the two and broadens the field.

Additionally, the survey adds a wide range of covariates to the analysis that are usually not included in administrative data sets and answers question marks about portfolio distortions. The most beneficial characteristic of the DHS data is that detailed diversification measures can be compared against the covariates that are suspected to have the biggest impact and typically the data available in household finance is substantially less detailed. This means that the research paper contributes with new understanding in the area which could have significant implications for how policies and the like should be formulated.

The study indicates that uncompensated risk-taking is the primary driver of a high return loss and that those who neither seek financial advice nor have high levels of financial literacy or numeracy have the highest return losses. The most likely cause of this is determined to be overconfidence and overestimation of own abilities leading some of those with low financial abilities to not seek any help. The main reason for a large return loss is therefore investment mistakes. This implies that policies to minimize welfare losses due to inferior investment strategies should focus on increasing the financial abilities of the population and encouraging or enabling financial advice for those with subpar financial knowledge and understanding. As the effect of financial advice has been a hot topic in recent years (per 2011), this is a significant contribution to the field.

Overall, the effect of financial numeracy is found to be small and insignificant. The findings differ from some previous theories as professional advice and financial numeracy are determined not to be complements or substitutes. It is however concluded that financial-numerical skill has a larger impact on investment outcomes than financial knowledge, which indicates that it is the mathematical side of understanding finance that is the most important to target with policies. Cognitive abilities are found to be important and additionally, they have a large positive impact on market participation, so early interventions targeting cognitive skills should be important policy tools. This is another current important conversation in the scientific community that the study can add value to.

According to the data, losses are spread over the different levels of wealth among investors, and large financial wealth indicates a higher return loss across the distribution, but it also correlates with greater participation in the market. This information can help determine where in the population policy measures should be focused. However, the results showed that a majority of households had reasonably efficient investment outcomes considering the trade-off between risk and return. Often this was done by either limiting the level of risk or seeking external advice. This indicates that the need for policies should be evaluated as well.

The study provides valuable insights into the drivers of diversification losses, and it emphasizes the significance of financial advice and financial numeracy among investors to avoid costly investment mistakes. The results are in many ways quite robust, but nevertheless, there are considerable limitations of the study, among those the ICAPM assumption and the reliance on self-reported data. With the notion that caution must be used when applying the findings to broader contexts, the study widens the diversity of the studies on this subject and provides nuance. The provided insights can be used by policymakers to construct policies targeting improving financial education and cognitive abilities, promoting market participation, and encouraging seeking financial advice. Additionally, this study can be used as a foundation for further research that can expand upon the variables measured and the populations researched, as well as provide more recent insights.

Conclusion

Gaudecker's study is an elaborate analysis of how financial literacy and financial advice affect portfolio diversification. Specifically, it is investigated how this impacts investment outcomes. Using detailed data on the Dutch population, a research gap is filled by expanding the data field of rigorous financial data from just Scandinavian households closer to a global perspective. Some well known empirical methods were used to analyze the data, such as ICAPM, and to be able to compare the data from different households, return loss was chosen as the diversification measure. Nevertheless, significant assumptions are made to yield these results which contribute important limitations to the findings of this study. With this in mind, important insights are offered about the circumstances where diversification losses occur, for instance, that the biggest losses happen when households have low financial literacy and do not apply financial advice. Despite weaknesses in the method, these results can be applied to creating policies and in future research, where focus on financial numeracy and cognitive abilities of young individuals is highlighted as an important policy feature in order to minimize welfare losses stemming from underdiversification.

Use of AI-tools

The generative AI-tool ChatGPT was used during the progress of this report but only to further our understanding of concepts and models. However, all text, including analysis and conclusions, were produced by the authors themselves. The use of ChatGPT was strictly supplementary and had no influence on the critical thinking or content of this report.

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