LEVERAGED STRUCTURED FINANCIAL PRODUCTS: TRADING MOTIVES AND PERFORMANCE

DECEMBER 2019

STEFFEN MEYER, KIM BÖVERS, LUTZ JOHANNING

PROF. DR STEFFEN MEYER
STME@SAM.SDU.DK

PROF. DR LUTZ JOHANNING
LUTZ.JOHANNING@WHU.EDU

This study was prepared on behalf of the German Derivatives Association (Deutscher Derivate Verband, DDV). It is part of a comprehensive and ongoing research project on retail investors using structured financial products.

1. Introduction and Summary of Results

Investors trade derivatives (futures and options) at low costs for speculation and hedging purposes.[1] Whereas speculators use derivatives to exploit their expectations about the underlying price movements with a leveraged position, hedgers already hold the underlying and use derivatives to protect the underlying against adverse price movements. Both speculators and hedgers might, on the whole, benefit from the existence of these products. However, since data about trading motives is not available, there is no empirical evidence on real trading performance for hedgers and speculators. In this study, we analyse the characteristics and performance of German retail investors with three different trading motives (hedgers, speculators, and strategic hedgers) who trade leveraged structured financial products (LSFPs).

LSFPs are comprised of warrants (call and put options) and knock-out products (for example, down-and-out puts). They are characterised by leveraged participation in the performance of the underlying. If the market develops in the opposite direction to the expectations of the buyers, they face the risk of large losses. In the cases of extreme price movements in the opposite direction or knock-outs, investors may even suffer a total loss. LSFPs account for more than half of the overall turnover in retail structured financial products (SFPs).[2] At the same time, LSFPs represented only 3 percent of the total open interest in structured financial products in Germany (totalling 64 billion euros) as at the end of March 2018.[3] Whereas LSFPs are rather short-term investment vehicles, investment structured financial products (ISFPs) are long-term investments products with the main feature that the product risk is significantly lower than the underlying risk. Examples of these include discount certificates and reverse convertibles. ISFPs account for 97 percent of total open interest.

For the purpose of analysing the characteristics and performance of LSFP traders with different trading motives, we used a representative and unique data set of self-directed German retail investors of a large German online broker. The data set contained transactional data on 60,986 investors, of which 22,077 traded at least one LSFP between 2000 and 2015. These LSFP users were further broken down according to three trading motives.

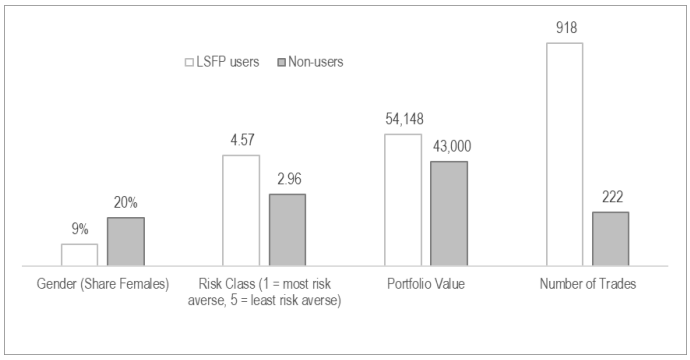
1. Hedgers aim at preventing large losses of investments. They already own the underlying or a related asset, and apply LSFPs as insurance instruments for which they might pay an insurance premium. The LSFPs of hedgers have negative leverages (the LSFP price moves in a direction opposite to the underlying price).
2. Strategic hedgers utilise LSFPs as investment vehicles rather than for speculation. They hold these products to benefit from the leverage while at the same time having protection against downside risks. Compared to an investment in the underlying asset, a replicating portfolio containing an LSFP can restrict the losses and does not require frequent monitoring. In this sense, strategic hedgers buy LSFPs not only as an asset, but also as an investment strategy. Strategic hedgers use LSFPs with positive leverage and longer holding periods compared to speculators.
3. Speculators try to profit from short-term market movements. They use LSFPs to profit from trading them as single financial instruments. We allocated trades to speculators if they did not belong to any other group.

[1] See, for example, https://www.investopedia.com/terms/o/option.asp, November 3, 2019.
[2] See Deutscher Derivate Verband, 2018b.
[3] See Deutscher Derivate Verband, 2018a.

We conjecture that different trading motives have an influence on returns; in particular, hedgers should pay an insurance premium on average. We can summarise the following results:

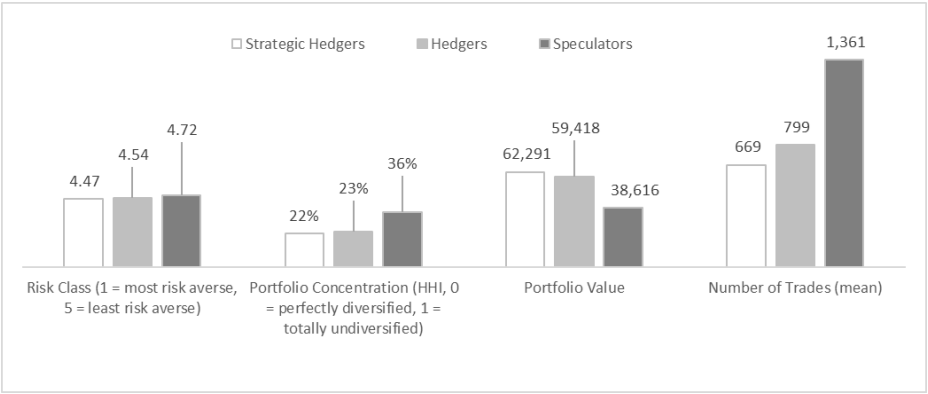
1. **Characteristics of LSFP investors and trading motives (Chapter 3):** In our full sample of 60,986 investors, we found that, between 2000 and 2015, these investors had an average portfolio value of 47,035 euros, an average risk class of 3.54 out of 5, and an average of 474 trades (particularly in individual stocks, funds, and SFPs). Some 22,077 of these investors used LSFPs at least once between 2000 and 2015. A total of 91 percent of these LSFP users were men; for non-users the percentage was only 80 percent. LSFP users had a portfolio value that was, on average, 25 percent larger than the portfolio value of non-users. They were much less risk averse (risk class 4.57 compared to 2.96 for non-users), and traded four times as much in all products (SFPs, stocks, and funds) as non-users between 2000 and 2015 (see Figure 1). These results show that LSFP users are, in principle, aware of product features and characteristics, are experienced in terms of trading activity, and use these products deliberately.

Figure 1: Characteristics of LSFP Users and Non-Users (2000 – 2015)



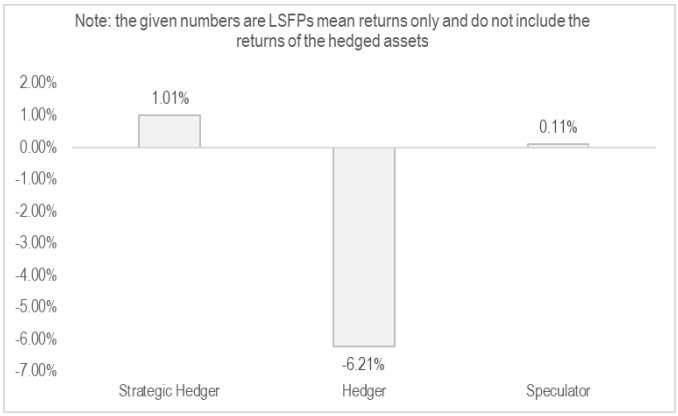
In the second step, we broke down the 22,077 LSFP users into the three trading motives (see definition above) and identified 5,380 hedgers (24.4 percent), 9,756 strategic hedgers (44.2 percent), and 6,941 speculators (31.4 percent). The trading motives demonstrated large differences with respect to the risk classes (speculators were less risk averse on average), portfolio diversification (speculators had less diversified portfolios), portfolio values (speculators had the lowest value), and number of trades across all products (speculators traded significantly more than the strategic hedgers and hedgers on average). Figure 2 summarises the results, which were fully in line with our expectations.

Figure 2: Characteristics of Trading Motives of LSFP Users (2000 – 2015)



2. **Performance and trading motives (Chapter 4):** In order to determine the performance of different trading motives, we first computed round-trip returns as the difference between the price of purchase and sale for every trade using a first-in, first-out approach. These round-trip returns included the performance of knock-out events and where the product expired worthless. In our sample, the 22,077 LSFP users generated more than 17 million trades including knock-outs. While the average LSFP round-trip return was -0.79 percent, the median round-trip return was 1.97 percent, which implied that more than 50 percent of all trades had significant positive returns. We distinguished the round-trip returns for different trading motives, and found that hedgers had a negative return of -6.21 percent on average. Note that this was only the return of LSFPs and did not include the return of the hedged asset. Strategic hedgers had positive round-trip returns averaging 1.01 percent, and speculators a positive round-trip return averaging 0.11 percent (see Figure 3).

Figure 3: Gross Mean Returns of LSFP Users differentiated by Trading Motives



Overall, these results fully confirmed our expectations, especially the results for hedgers, who paid an insurance premium and therefore generated negative round-trip returns. The overall negative mean performance of -0.79 percent was solely driven by the high negative returns of hedgers.[4] These results show that it is not meaningful to assess LSFPs by solely looking at average performance. Instead, it is necessary to distinguish trading motives and their performance. In addition, these results imply a need to improve the educational work on the consequences of trading motives in general and hedging in particular. Since LSFP investors are, in principle, aware of product features and characteristics, and are experienced, this educational work might quickly lead to even better applications of LSFPs, especially for hedging purposes.

This study is part of a comprehensive and ongoing research project on retail investors using structured financial products. It complements existing studies such as Celerier et al. (2016), Entrop et al. (2016), Vokatá (2018), and Müller et al. (2017). Whereas those studies either focused on the design of product features or on their ability to nudge people into stock market participation by mitigating behavioural biases, this study is among the first to investigate the impact of SFPs (and particularly LSFPs) on real investor portfolios by analysing the entire spectrum of structured financial products, including potential motives for trading decisions. In the following, we present descriptive results and figures. These results are fully in-line with multivariate regression results, which we present in our research paper. Throughout the study, we present product returns, which include product costs such as issuer margins, but not brokerage fees

[4] The average round-trip return is the weighted average return of the three trading motives with the number of trades as weight.

(gross returns), as these might be brokerage-specific and thus difficult to generalise. In addition, free trading arrangements between issuers and brokers might even lead to zero-cost trades for investors. For studies analysing the costs of structured products, see, for example, Szymanowska et al. (2009), Müller et al. (2017), and Döhrer et al. (2013). For results on brokerage costs in stock trading, see Barber & Odean (2000) and Barber & Odean (2001).

2. Data and Trading Motives

In order to identify the trading motives, we combined three data sets. The first data set, which we received from issuers, consisted of information on the type and nature of around 15.1 million structured financial products issued between 2000 and 2015. The data included the name of the underlying, the issuance date, whether it was a put or call option, and information on the security's SFP category. The second data set contained the ISIN of the respective underlying of SFPs, and came from Börse Stuttgart (Stuttgart stock exchange). The third data set contained data on private investor transactions, including information on every self-directed trade executed by roughly 100,000 retail investors at a large German direct brokerage from January 1999 to December 2015. Apart from the transactional data, the sample also included pseudonymised direct and indirect information on investor characteristics (e.g., age, gender, sophistication, portfolio value, and whether a client received financial advice). Products and trades of investors were matched using the ISIN of a security.

For the final sample, we only looked at investors who traded at least once every year in the sample period. Additionally, to make sure we only investigated the trading of investors who initiated these transactions on their own, we excluded investors who used financial advice as well as transactions that stem from automated trading, like saving plans or limit orders. This way we ended up with only those transactions that were based on a particular decision of an individual investor and a sample size of 60,986 investors. This final sample of retail clients traded all types of products, including investment and leveraged structured financial products.

Table 1 shows descriptive statistics of the whole sample of investors in our final data set. The average investor age was 53 years old, and they had an average portfolio value of 47,035 euros. Of our sample, 84 percent were male and 16 percent were female. With an average risk class of 3.54 and a median risk class of 4 out of 5, these investors traded in rather risky securities. This is also reflected in the lower panel, which focuses on the investors' trading activity in the predominant asset classes. Investors made an average of 474 trades during the sample period. Subdividing these trades into asset classes, there were 214 trades in individual stocks, 93 trades in funds, and 162 trades in SFPs; the remainder were trades in other financial products. In terms of the usage of asset classes, individual stocks were the most popular product, traded by 92 percent of the investors. In addition to these, 83 percent of investors used funds, and 56 percent used SFPs.

Table 1 (Extract, the full table is in the Appendix, Table A.1): Descriptive Statistics of all Investors

		All Investors		
		Observations	Mean	Median
Personal & Portfolio Characteristics	**Unit**			
Gender (share females)	percent	60,986	16%	0%
Risk Class (1 = most risk averse, 5 = least risk averse)	category	60,986	3.54	4.00
Age	years	60,986	52.82	52.00
Portfolio Value	euros	60,986	47,035	28,235
Trading Characteristics				
Total Number of Trades	count	60,986	474	195
Number of Trades in Individual Stocks	count	60,986	214	60
Number of Trades in Funds	count	60,986	93	19
Number of Trades in SFPs	count	60,986	162	2
Average Date of first trading SFPs	date	33,945	15.06.2005	06.06.2005
Usage of Asset Classes				
Usage of Individual Stocks (1 = one trade in stocks)	percent	60,986	92%	100%
Usage of Funds (1 = one trade in funds)	percent	60,986	83%	100%
Usage of SFPs (1 = one trade in SFPs)	percent	60,986	56%	100%

Based on our unique and representative data set, we estimated the size of LSFP users to be roughly 750,000 between 2000 and 2015. However, the number of LSFP users varied over time; for example, the estimated number of LSFP users was around 400,000 at the end of 2015. See the Appendix as well as Figure A.1 for a more detailed investigation of the representativeness and the derivation of the number of LSFP users.

3. Characteristics of LSFP Users versus Non-LSFP Users and Trading Motives

In a first step, we sought to understand which investor characteristics and trading behaviours affected the probability of purchasing a leveraged structured financial product. Table 2 (see also Figure 1) gives information on the descriptive statistics of LSFP users (investors who traded an LSFP at least once between 2000 and 2015) compared with those of investors not using these products. It was statistically significant at the 1 percent level that users of LSFPs were more likely to be male (91 percent vs. 80 percent), less risk averse (average risk class of 4.57 vs. 2.96) and have a higher portfolio value (54,148 vs. 43,000 euros). They traded more heavily when looking at the average number of total trades over a period of 16 years (918 vs. 222). Users of LSFPs traded more in all asset classes. For example, trades in individual stocks were three times as high as those of non-LSFP users (375 vs. 123). In addition, 98 percent of the users of LSFPs traded individual stocks, while only 88 percent of the non-users traded this asset class. In contrast, the share of investors trading equity funds was statistically significantly higher for the non-user category, suggesting that the users of LSFPs are more interested in individual securities.

Table 2 (Extract, the full table is in the Appendix, Table A.2): Descriptive Statistics of LSFP Users versus Non-Users

		Investors not using LSFPs		Users of LSFPs		
		Mean	Median	Mean	Median	p-value
Personal & Portfolio Characteristics	**Unit**					
Gender (share females)	percent	20%	0%	9%	0%	0%
Risk Class (1 = most risk averse, 5 = least risk averse)	category	2.96	3.00	4.57	5.00	0.00
Portfolio Value	euros	43,000	27,231	54,148	30,354	0.00
Trading Characteristics						
Total Number of Trades	count	222.28	111.00	918.36	478.00	0.00
Number of Trades in Individual Stocks	count	123.43	33.00	374.59	152.00	0.00
Number of Trades in SFPs	count	3.49	0.00	440.12	98.00	0.00

In the next step, we split the trades of private investors in LSFPs into three dimensions: first, whether they had short or long holding periods; second, whether the leverage was positive or negative; and third, whether there was a positive equity share in the portfolio of the corresponding investors. Leverage was based on the movement of the LSFP relative to the movement of its underlying over the longest observable time period. If the leverage was positive, the LSFP return was a multiple of the positive return of the underlying. It was negative if the price of the LSFP moved in the opposite direction to the price of the underlying.

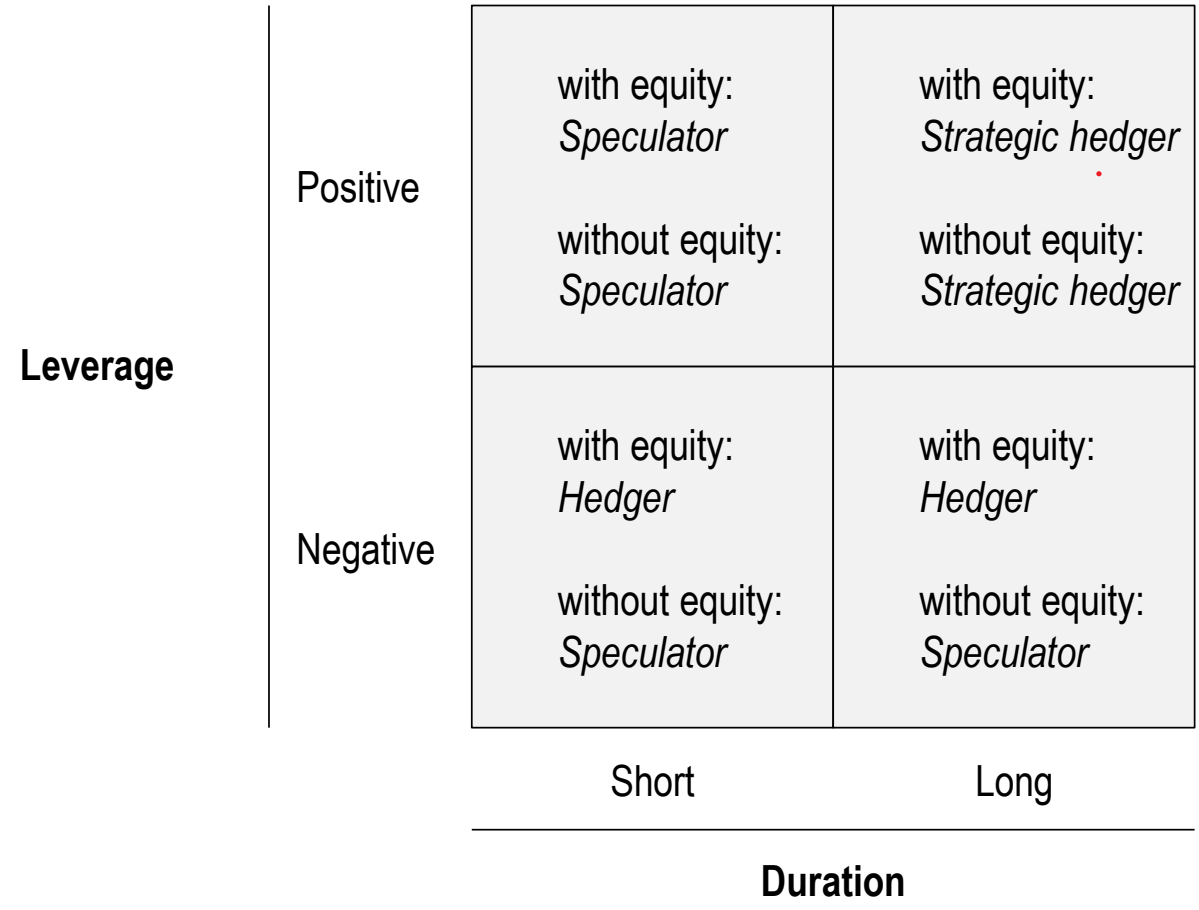
If investors aim at building hedging positions using LSFPs, they need to have direct or related positions in the underlying and use LSFPs with a negative leverage. The analysis of underlying investments showed that the majority of them were comprised of well-known, broad equity indices, particularly the DAX (28 percent of underlyings, with no other underlying exceeding 5 percent). We used this information to approximate the underlying by splitting investors, based on them having a positive equity share (either in individual stocks or funds that have an equity exposure or ETFs) or not having equity positions in their portfolios at the end of the month before an LSFP transaction took place. Indirect equity investments in mutual funds were considered based on the peer group the fund was trading in. Every trade aimed at hedging requires an investor to have a positive equity share. In addition, the direction of the leverage determines the motivation for a trade. If an investor wants to hedge using LSFPs, it is only possible with a product that has a negative leverage in combination with a long position in equity. Consequently, it can protect investors from losing money with their direct investment. In return, they have to accept the costs that come with hedging in that they lower their returns from a portfolio perspective. We classified every trade to be a hedge if the investor's portfolio had a positive equity share and if the LSFP had negative levels of leverage.

The second group of investors that could be distilled from the investigation of trades has longer investment horizons and positive leverage. They focus on buy-and-hold strategies in LSFPs, which offer the possibility to disproportionately profit from rising asset prices in the long term while also having protection against downside risks. Compared to an investment in the underlying asset, a replicating portfolio containing an LSFP can restrict losses and does not require frequent monitoring. We label these investors strategic hedgers.

All of the remaining combinations classify an investor as a speculator, either because there is a rather short duration (holding period) or because there is no positive equity share in the portfolio. All these positions are opened to generate returns.[5]

The following illustration in Figure 4 gives an overview of the trader types. Investors were classified according to the direction of leverage, the duration of trades, and whether they had a positive equity share. We grouped investors by the most frequent trading motive into the respective class. Where there were draws, we randomly chose a class. Following this classification, 44.2 percent of the investors were strategic hedgers, 24.4 percent were hedgers, and 31.4 percent were speculators. We were interested in grouping and describing investors. An alternative approach would have been to look at every transaction and determine situations and market environments in which those motives prevailed. This would be a potential approach for future research.

Figure 4: Investor Classifications based on Round-Trip Duration, Leverage and Portfolio Composition



As these investor groups seemed to have different trading motives, the next step was to analyse whether their personal and investment characteristics differed. Table 3 (see also Figure 3) gives descriptive statistics of LSFP investors by investor classifications. We were able find major differences, especially for trading characteristics. The two hedger groups had HHI[6] values of 0.22 and 0.23, which reflected quite

[5] We had no information about the existence of other investor brokerage or bank accounts.

[6] The Herfindahl-Hirschman Index (HHI) is a measure of portfolio concentration. It ranges from 100 percent (totally undiversified) to close to 0 (perfectly diversified). Lower numbers hence indicate better diversified portfolios. It is defined as

diversified portfolios. For speculators, the HHI was 0.36, and thus their portfolios were less diversified on average. These differences became even more evident with respect to the number of trades executed during our sample period. With an average of 1,361 trades in all asset classes (stocks, funds, and SFPs), speculators were twice as active as hedgers, and this factor was even greater compared to strategic hedgers. Their average risk class was higher as well, indicating lower risk aversion. Finally, strategic hedgers and hedgers had significantly higher average portfolio values than speculators.

Table 3: Descriptive Statistics of LSFPs Users by Trading Motive

		Strategic Hedger			Hedger			Speculator		
		Observations	Mean	Median	Observations	Mean	Median	Observations	Mean	Median
Personal & Portfolio Characteristics	**Unit**									
Gender (share females)	percent	9,756	10%	0%	5,380	9%	0%	6,941	0.08	0.00
Risk Class (1 = most risk averse, 5 = least risk averse)	category	9,756	4.47	5.00	5,380	4.54	5.00	6,941	4.72	5.00
HHI (1 = not diversified)	percent	9,756	22%	16%	5,380	23%	17%	6,941	0.36	0.30
Self-employed	percent	9,756	22%	0%	5,380	22%	0%	6,941	0.25	0.00
Age	years	9,756	53.97	53.00	5,380	52.64	51.00	6,941	52.00	51.00
Portfolio Value	euros	9,756	62,291	36,168	5,380	59,418	33,918	6,941	38,616	19,273
Academic Title	percent	9,756	7%	0%	5,380	7%	0%	6,941	0.05	0.00
Married	percent	9,756	60%	100%	5,380	59%	100%	6,941	0.55	1.00
Trading Characteristics										
Total Number of Trades	count	9,756	669.10	392.00	5,380	799.45	435.00	6,941	1,360.86	700.00
Usage of Asset Classes										
Usage of Individual Stocks (1 = one trade in stocks)	percent	9,756	98%	100%	5,380	99%	100%	6,941	0.97	1.00

4. Round-Trip Performance and Trading Motives

Based on these characteristics, we set out to look at the performance figures in LSFP trading for each group. First, the LSFPs of hedgers, who have a positive equity share and a negative LSFP leverage, yielded positive returns whenever the underlying did not and could protect them from large losses. Overall, this hedging purpose should come at a cost comparable to that of an insurance premium. Second, speculators were defined as actively trading these securities to achieve high returns. The large number of trades we see in the previous table might be a main driver of the net performance. They might trade too much provided the value their trading yields. This is in line with the literature on heavily trading private investors (see, for example, Odean, 1999 or Barber & Odean, 2000). However, as the trades of speculators might be smaller than the trades of hedgers and strategic hedgers, the effects of overtrading might be limited. Third, strategic hedgers had a more long-term perspective in their trades and positive leverages. This means that they disproportionally benefit from rising prices in the underlying of the LSFP. They, in fact, benefit from the positive equity premium, but the dynamic downside protection implies higher negative performance effects from knock-outs.

In order to determine the performance of different trading motives, we first analysed round-trip returns, which are the total return of a completed transaction. Thus, they measure the difference between the price of purchase and the sale price using the assumption of first in, first out. They account for the actual holding period of every security and also include knock-outs, products that expire worthless, and remaining products in the portfolio.

the sum of the squares of the portfolio shares of every security within an investor portfolio. The HHI is computed on a monthly basis, and then averaged by investor. A fund is treated as containing 100 individual securities.

In our sample, the 22,077 LSFP users generated more than 17 million trades including knock-outs. Looking at completed round trips, investors held LSFPs 15 trading days on average. While the average LSFP round-trip return was -0.79 percent, the median round-trip return was 1.97 percent, which implied that more than 50 percent of all trades had significant positive returns. The 25th percentile round-trip return was -16.4 percent and the 75th percentile return was 15.9 percent. These numbers show that the round-trip return distribution is somewhat skewed to the left.

Table 4: Gross Mean Round-Trip Returns for different Trading Motives

Note: the given numbers are LSFPs mean returns only and do not include the returns of the hedged assets.

	Gross Return
Strategic Hedger	1.01 %
Hedger	-6.21 %
Speculator	0.11 %
Overall	-0.79 %

We distinguish the round-trip returns for different trading motives in Table 4 and Figure 3. Note, the given numbers only show the returns of LSFPs and do not include the returns of the hedged assets. The table shows large differences in returns between different trading motives. Hedging with LSFPs came with a cost of around 6 percent (the insurance premium). Bearing in mind the purpose of protecting investors from large losses in the underlying investment, these insurance premiums might have been well spent and in line with investors' intentions and/or utility functions, as well as in line with our expectations. In contrast, those investors who were classified as strategic hedgers based on their long-term perspective and positive levels of leverage had positive returns of 1.01 percent. Investors classified as speculators had a small but positive gross return. Overall, these results fully confirmed our expectations outlined above.

We thank Dr Wolfgang Gerhardt for his helpful comments.

Bibliography

Bailey, W., Kumar, A., & Ng, D. (2011). Behavioral biases of mutual fund investors. *Journal of Financial Economics, 102*(1), 1-27.

Barber, B. M., & Odean, T. (2000). Trading is hazardous to your wealth: The common stock investment performance of individual investors. *The Journal of Finance, 55*(2), 773-806.

Barber, B. M., & Odean, T. (2001). Boys will be boys: Gender, overconfidence and common stock investment. *Quarterly Journal of Economics, 116*, 261-292.

Bhattacharya, U., Loos, B., Meyer, S., & Hackethal, A. (2016). Abusing ETFs. *Review of Finance*, 1217-1250.

Calvet, L. E., Campbell, J. Y., & Sodini, P. (2007). Down or out: Assessing the welfare costs of household investment mistakes. *Journal of Political Economy, 115*(5), 707-747.

Celerier, C., Vallee, B., Calvet, L. E., & Sodini, P. (2016). Financial Innovation and Stock Market Participation.

Deutsche Bundesbank. (2017). Statistik über Wertpapierinvestments. https://de.statista.com/statistik/daten/studie/709806/umfrage/anzahl-der-wertpapierdepots-in-deutschland/.

Deutscher Derivate Verband. (2018a). *Marktvolumen* Retrieved from https://www.derivateverband.de/DEU/Statistiken/Marktvolumen.

Deutscher Derivate Verband. (2018b). *Boersenumsaetze*. Retrieved from https://www.derivateverband.de/DEU/Statistiken/Boersenumsaetze.

Dhar, R., & Zhu, N. (2006). Up close and personal: Investor sophistication and the disposition effect. *Management Science, 52*(5), 726-740.

Döhrer, B., Johanning, L., Steiner, N., & Völkle, A. (2013). Emittentenmargen bei Zertifikaten.

Entrop, O., McKenzie, M., Wilkens, M., & Winkler, C. (2016). The performance of individual investors in structured financial products. *Review of Quantitative Finance and Accounting, 46*(3), 569-604.

European Central Bank (2017): The Household Finance and Consumption Survey (Wave 1). Available online at https://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_hfcn.en.html.

Frühauf, M. (2014). Direktbanken müssen ihre Kräfte bündeln. *Frankfurter Allgemeine Zeitung*, 1 August 2014, URL: https://www.faz.net/aktuell/wirtschaft/wirtschaftspolitik/finanzinstitute-direktbanken-muessen-ihre-kraefte-buendeln-13076763.html

Kostopoulos, D., & Meyer, S. (2017a). Disentangling Investor Sentiment: Mood and Economic Expectations.

Kostopoulos, D., & Meyer, S. (2017b). Google Search Volume and Individual Investor Trading.

Loos, B., Meyer, S., & Hackethal, A. (2016). Fee-based Financial Advice.

Müller, S., Johanning, L., Koziol, C., Schiereck, D., & Rudolph, B. (2017). Total costs and cost components of investment in retail structured products. (Study December 2017).

Odean, T. (1999). Do Investors Trade Too Much? *American Economic Review, 89*(5), 1279-1298.

Stoimenov, P. A., & Wilkens, S. (2005). Are structured products 'fairly'priced? An analysis of the German market for equity-linked instruments. *Journal of Banking & Finance, 29*(12), 2971-2993.

Szymanowska, M., Horst, J. T., & Veld, C. (2009). Reverse Convertible Bonds Analyzed. *Journal of Futures Markets, 29*(10), 895-919.

Vokatá, P. (2018). Engineering Lemons.

Wilkens, S., Erner, C., & Roder, K. (2003). The Pricing of Structured Products in Germany. *Journal of Derivatives, 11*, 55-69.

Appendix

Representativeness

Was the data to be used representative of the German self-directed retail investor? In order to address this question, we drew two comparisons. First, we compared the sample averages to aggregate information obtained from the European central bank and second, we looked at socio-demographics of investors in other countries.

The official statistics provided by the European Central Bank's Household Finance and Consumption Survey indicate that the average portfolio values of German stock market investors total 48,000 euros (European Central Bank, 2017). This number is very comparable to the one we found in our data, which shows that the investors in our sample are highly representative of the average German investor. What is more, with a portfolio value of this magnitude, we are confident that these accounts were not play-money accounts. We note that using data from an online brokerage may reflect the behaviour of self-directed stock market participants fairly well, but it may not be as representative of clients at brick-and-mortar banks, who are known to rely on financial advice and where the advisory processes usually favour mutual funds over direct stock investments or structured financial products.

To investigate whether our data is specific to Germany, we further compared our trading data to other empirical studies on private investor trading that have conducted internationally. While the average age was 52 in our sample, Barber & Odean (2001) and Calvet, Campbell and Sodini (2007) describe an average age of 50 (U.S. data) and 51 years (Swedish data), respectively. The male share of 84 percent in our sample is comparable to the share of 79 percent in the sample of Barber and Odean (2001). The average portfolio value of 47,000 euros in our sample is between the values of the samples of Barber and Odean (2001), and Calvet, Campbell and Sodini (2007) totalling 57,000 euros and 35,000 euros, respectively.

Data sets like the ones used are standard in academic research. Researchers have addressed questions related to trading volume (Odean, 1999), trading behaviour (Dhar & Zhu, 2006), trading of funds and ETFs (Bailey, Kumar, & Ng, 2011, Bhattacharya et al., 2016), trading on sentiment (Kostopoulos & Meyer, 2017a, b), and on the effects of financial advice (Loos, Meyer, & Hackethal, 2016). Lately, academic research has focused on retail asset allocation decisions with respect to structured financial products, placing particular focus on non-leverage products and providing, for example, an assessment of private investor performance in the areas of discount and bonus certificates in selected European markets (e.g., Entrop et al., 2016). They have also been shown to foster stock market participation of loss-averse investors in Sweden (Celerier et al., 2016).

Overall, we are very confident our data offers a comprehensive picture of the trading of self-directed retail investors. We would like to point out that having additional data from a range of different banks and different countries obviously supports the robustness and the generalisability of the results presented.

As Figure A.1 shows, between 2000 and 2008, the absolute number of SFP users per month (measured as the number of investors with at least one SFP in their portfolio in the corresponding month) increased sharply and reached its maximum of more than 25,000 users of 60,986 investors in our sample in 2008.

Even though this number decreased after 2008, it did not fall below 15,000 investors using SFPs. While the number of investors using ISFPs and LSFPs increased similarly until 2006, LSFPs were used more heavily afterwards. Towards the end of the sample, users of both product categories converged to a level of 10,000. Note that these numbers refer to self-directed investors. The number of LSFP users at branch banks was smaller.

In Germany, there are about 26 million security accounts in sum over every type of brokerage (Deutsche Bundesbank, 2017). Direct brokerages have a market share of 8 percent (Frühauf, 2014). Combining this value with the number of security accounts, there are approximately two million accounts at direct brokerages in Germany. As our sample shows, roughly 56 percent of all investors use SFPs (33,945 of 60,986), meaning that there are around 1.16 million German investors in structured financial products. Relating these numbers to 26 million security accounts, 4.4 percent of them contain SFPs. Focusing on LSFPs, this number decreases to roughly 750,000 investors or 3 percent of accounts (22,077 of 60,986 in our sample) between 2000 and 2015.

Figure A.1: The number of SFP Users over Time

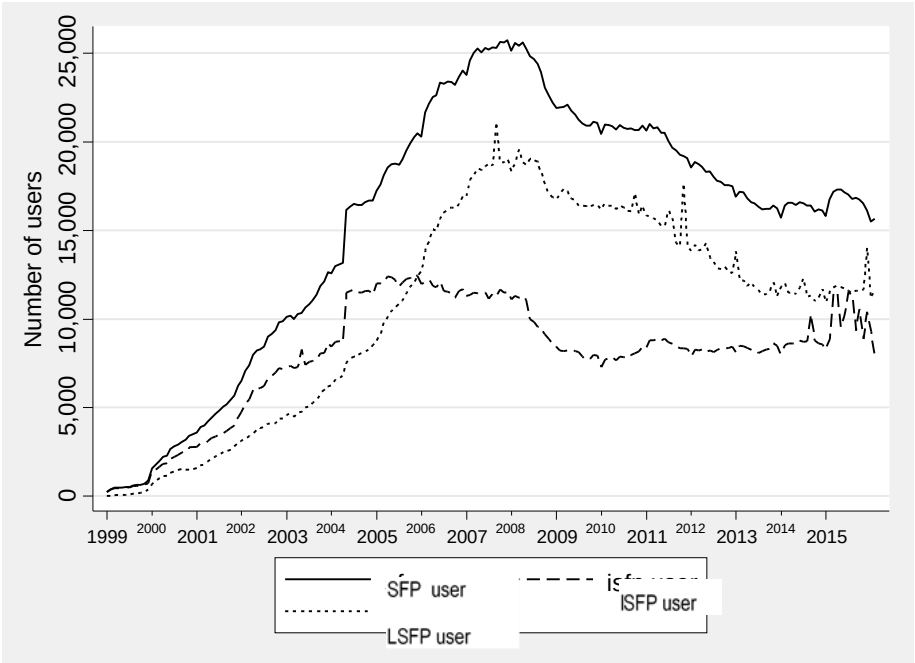


Table A.1: Descriptive Statistics of all Investors

		All Investors		
		Observations	Mean	Median
Personal & Portfolio Characteristics	**Unit**			
Gender (share females)	percent	60,986	16%	0%
Risk Class (1 = most risk averse, 5 = least risk averse)	category	60,986	3.54	4.00
HHI (1 = not diversified)	percent	60,986	22%	15%
Self-employed	percent	60,986	20%	0%
Age	years	60,986	52.82	52.00
Portfolio Value	euros	60,986	47,035	28,235
Academic Title	percent	60,986	7%	0%
Married	percent	60,986	59%	100%
Trading Characteristics				
Total Number of Trades	count	60,986	474.26	195.00
Number of Trades in Individual Stocks	count	60,986	214.35	60.00
Number of Trades in Funds	count	60,986	93.19	19.00
Number of Trades in SFPs	count	60,986	161.55	2.00
Value of Trades in SFPs	euros	60,986	1,023,759	4,039
Average Date of First Trading SFPs	date	33,945	15.06.2005	06.06.2005
Average Date of First Trading ISFPs	date	26,626	06.07.2006	07.04.2006
Average Date of First Trading LSFPs	date	22,077	22.01.2005	21.05.2004
Usage of Asset Classes				
Usage of single Stocks (1 = one trade in stocks)	percent	60,986	92%	100%
Usage of Funds (1 = one trade in funds)	percent	60,986	83%	100%
Usage of SFPs (1 = one trade in SFPs)	percent	60,986	56%	100%
Usage of ISFPs (1 = one trade in ISFPs)	percent	60,986	44%	0%
Usage of LSFPs (1 = one trade in LSFPs)	percent	60,986	36%	0%

Table A.2: Descriptive Statistics of LSFP Users vs. Non-Users

		Investors not using LSFPs			Users of LSFPs				
		Observations	Mean	Median	Observations	Mean	Median	Delta	p-value
Personal & Portfolio Characteristics	**Unit**								
Gender (share females)	percent	38,909	20%	0%	22,077	9%	0%	-10%	0.00
Risk Class (1 = most risk averse, 5 = least risk averse)	category	38,909	296%	300%	22,077	457%	500%	161%	0.00
HHI (1 = not diversified)	percent	38,909	20%	13%	22,077	27%	20%	7%	0.00
Self-employed	percent	38,909	20%	0%	22,077	23%	0%	3%	0.00
Age	years	38,909	52.71	51.00	22,077	53.03	52.00	0.32	0.00
Portfolio Value	euros	38,909	43,000	27,231	22,077	54,148	30,354	11,148	0.00
Academic Title	percent	38,909	0.07	0.00	22,077	0.07	0.00	-0.01	0.01
Married	percent	38,909	0.59	1.00	22,077	0.58	1.00	-0.01	0.02
Trading Characteristics									
Total Number of Trades	count	38,909	222.28	111.00	22,077	918.36	478.00	696.07	0.00
Number of Trades in Individual Stocks	count	38,909	123.43	33.00	22,077	374.59	152.00	251.16	0.00
Number of Trades in Funds	count	38,909	91.83	18.00	22,077	95.57	22.00	3.74	0.02
Number of Trades in SFPs	count	38,909	3.49	0.00	22,077	440.12	98.00	436.62	0.00
Value of Trades in SFPs	euros	38,909	264,200	0.00	22,077	2,362,422	307,032	2,098,223	0.00
Usage of Asset Classes									
Usage of Individual Stocks (1 = one trade in stocks)	percent	38,909	88%	100%	22,077	98%	100%	10%	0.00
Usage of Funds (1 = one trade in funds)	percent	38,909	84%	100%	22,077	81%	100%	-2%	0.00
Usage of ISFPs (1 = one trade in ISFPs)	percent	38,909	31%	0%	22,077	67%	100%	36%	0.00
Usage of LSFPs (1 = one trade in LSFPs)	percent	38,909	0%	0%	22,077	100%	100%	100%	0.00