The Demand Function for Bank-Issued Warrants[1]

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Bank-issued warrants are securitized options which are particularly designed to give smaller individual investors the opportunity to participate in the derivative markets. As banks incorporate potentially different margins on top of the theoretical fair values of the products, investors face the problem of choosing an optimal product. While previous literature has characterized individual investors as "noise traders", this paper finds that they do act price-sensitively. In particular, we provide evidence that demand decreases with increasing margins, but also show that larger investors still realize lower margins than smaller investors.

Keywords: bank-issued options, price sensitivity, retail derivatives, retail investors, warrants

1. Bank-Issued Warrants vs. Classical Warrants

Since the late 1990s, banks and other financial institutions in Europe and Asia have been issuing securitized options, also referred to as warrants, which are primarily aimed at the individual investor. In contrast to US and other warrant markets, where warrants are usually written on the issuer's own stock, these bank-issued warrants have a broad range of underlying securities, e.g., various single stocks, stock indices, or commodities. While the "traditional" warrants entitle the holder to buy new shares of the issuing companies, bank-issued warrants in Europe and Asia refer to existing shares, or, are simply cash-settled, i.e., they pay the holder a cash amount equal to the intrinsic value at maturity. By the nature of this security design, the bank always takes the short position, and the investor always takes the long position. After issuance, the warrants are traded on an exchange. In many European and Asian countries, markets for bank-issued options coexist with "classical" options markets organized by options exchanges. On an options exchange, market participants deal with a central counterpart and a number of (competing) market makers. In contrast, the counterpart and at the same time the market maker for bank-issued options is the issuing bank itself. As a consequence, investors of bank-issued options face the risk of a default of the issuer, while with an options exchange this risk is eliminated by a central clearing house. Another major difference is the market access for small investors. To trade on an options exchange, an individual investor usually has to sign a special agreement with a broker. Furthermore, minimum trading lots apply, which can be too high for small investors. In contrast, bank-issued warrants are especially designed also for small investors who can trade these instruments with small volumes and fewer restrictions.

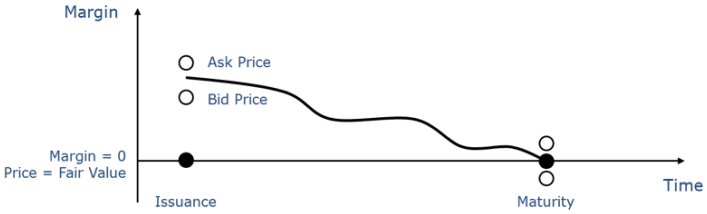
2. Bank Margins and Investors' Choice

2.1 Banks' Price-Setting Policy

Issuers of retail derivatives charge prices above the product's theoretical fair model value (e.g., Entrop et al., 2009). This difference between theoretical fair values and quoted prices is the "margin" (see Figure 1). At issuance, usually both the bid price and the ask price are higher than the theoretical value. The ask price must be higher than the theoretical value to cover structuring costs, marketing costs, and other operational costs of the bank, and to

ensure a profit contribution for each product sold to an investor. Furthermore, banks usually set the bid price close to the ask price to send a signal of quality to investors: While the theoretical fair value and thus the margin is not directly observable, the bid-ask spread is. Because of the restriction on short-selling, banks need not fear arbitrage by other market participants when the bid price is above the theoretical fair value.

Figure 1: Definition of the margin and its decrease over time



Notes: Near issuance, both the ask price and the bid price are usually above the theoretical fair value. The gross margin is defined as the difference between the midpoint of the bid-ask interval and the theoretical value. As a usual pattern, the margin decreases over the lifecycle of a product and reaches values near zero close to maturity.

Previous studies have shown that the margin decreases during the lifecycle of the products (e.g., Wilkens et al., 2003; Baule, 2011). Such a decrease is plausible; close to maturity, the theoretical value converges to the intrinsic value, which is observable and thus transparent. This transparency leaves little space for a margin, which must thus be close to zero.

2.2 How Can Investors Compare Margins?

However, as investors usually do not buy such products close to maturity, the opaqueness of the margin makes it difficult for them to compare the advantages of different products. For an accurate comparison of margins, investors would have to evaluate the products with appropriate mathematical valuation methods. The prevailing opinion in the literature is that individual investors are "noise traders" and lack the cognitive competence to conduct such a (mathematically demanding) comparison of margins (e.g., Meyer et al., 2014).

Nevertheless, even for individual investors with relatively low mathematical reasoning abilities, there are ways to deduce margins indirectly and thus to invest margin sensitively. Investors could find similar products of different issuers and compare these similar products with regard to their prices with the help of certain online finance portals. Such a comparison can either cover product properties or the issuing bank. For example, investors might specifically search for warrants written on the German market index DAX with a strike of 11,000 and a time to maturity of three months. Such a search produces hits from numerous different issuers. For identical product properties, investors can directly compare prices (neglecting only minor aspects like differences in the bank's credit rating or the bid-ask spread).

Another possibility would be for investors to search for "at the money" warrants with a strike between 10,500 and 11,500 written on the DAX. As product properties differ (slightly) in this case, a simple comparison of prices is hardly precise. Nevertheless, investors could compare indicators for the incorporated margin, such as the product's implied volatility, which is also provided by some online finance portals. This, at least, enables investors to indirectly choose the cheapest warrant with a relatively low degree of inaccuracy.

The mental effort for this approach, however, is not negligible. Many researchers doubt whether investors are able to perform higher orders of cognitive action (for an overview see Blonski & Blonski, 2015), and the question of whether a considerable proportion of investors really invests margin sensitively remains unanswered. Blonski (2014) and Baule & Blonski (forthcoming) credit individual investors with at least some cognitive abilities regarding their investment decisions. In the following we investigate this research question in more detail by analyzing the impact of margins on the demand for warrants.

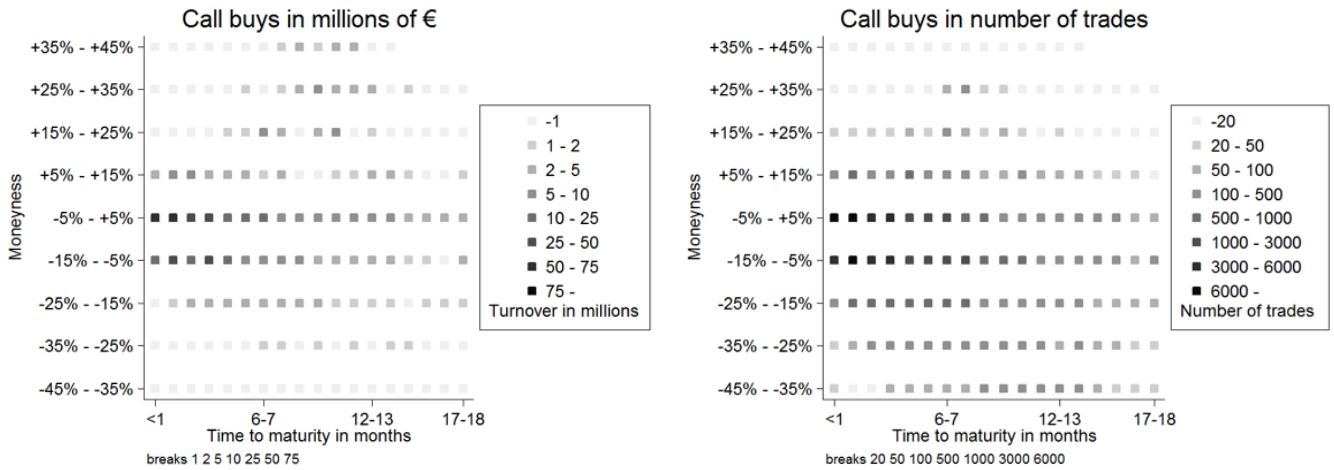
3. The Warrants Market on the European Warrant Exchange (EUWAX)

We analyze the demand for bank-issued warrants on the world's largest warrants market, the EUWAX in Stuttgart, Germany. There is an extremely large variety of different products on this market. As of May 2015, investors have a choice between more than 400,000 different warrants, in addition to another 1,000,000 other retail derivative products.

Our warrants data set covers all trades of plain-vanilla call warrants on the German market index, DAX, which were tradable on the EUWAX for a 1-year period, from January through December 2009. We concentrate on call warrants in order to avoid incorporating the early exercise premium of American-style put warrants as a potential source of pricing uncertainty. Figure 2 illustrates the trading activity of call warrants, grouped by moneyness and time to maturity. The upper graph shows the total turnover in million euro, the lower graph the total number of executed call orders. At-the-money and slightly-out-of-the-money calls with a remaining time to maturity of up to 9 months

show the highest trading activity. In general, trading activity decreases with longer times to maturity. Furthermore, the relevance of the differentiation between the two measures for trading activity becomes obvious here. For instance, deep-out-of-the-money calls with very short times to maturity exhibit a considerable trading activity in terms of executed orders, but a very small turnover in million euro. This is because short-term deep-out-of-the-money calls are extremely cheap.

Figure 2: Trading activity of DAX call warrants on the EUWAX separated by warrant characteristics



Notes: Warrants are clustered according to their remaining time to maturity and moneyness. The upper graph shows the total number of executed orders, the lower graph the total turnover in million euro. The brightness of each cluster indicates the trading activity, high trading activity being indicated by a dark cluster.

In order to create a homogenous dataset we focus on warrants written on the DAX issued by one of the largest five issuers in this market segment (Citibank, Commerzbank, Deutsche Bank, Goldman Sachs, HSBC). Furthermore, we only consider warrants with a time to maturity between one and twelve months and a moneyness of +15% to –15%, where moneyness is defined as the relative difference between underlying and strike price, (S-X)/S. This restriction rules out warrants with a value of a few cents (which are short-termed and/or deep-out-of-the-money). The resulting dataset contains about 23,000 buy transactions of call warrants at the EUWAX. The overall average margin charged by issuers amounts to 2.13% and the average trading volume per warrant and day to 4,000 euro. On average, due to the large variety of existing products, a single warrant is traded only every second day. Table 1 shows some further descriptive statistics about trading activities for different issuers and their margins.

Table 1. Descriptive Statistics

	Total Demand		Average Demand		Average Margin	
	Trades	Volume	Trades	Volume	Mean	Std.dev.
Citibank	3,588	35.064	0.36	3,250	3.56%	3.91%
Commerzbank	4,329	32.486	0.32	2,208	1.48%	3.40%
Deutsche Bank	12,955	115.302	0.76	6,292	1.76%	3.15%
Goldman Sachs	1,894	12.241	0.60	3,529	3.85%	4.94%
HSBC Trinkaus	401	2.578	0.19	1,118	0.16%	4.52%
Total	23,167	197.671	0.51	3,965	2.13%	3.75%

Notes: Categorized by issuer, the table provides the total trading volume (measured as number of trades and trading volume in million euro), furthermore the average demand figures (number of trades per warrant and per day, trading volume per warrant and day in euro), and finally the average margin and the standard deviation of the margin. The figures are restricted to our subsample, that is, warrants on the DAX with moneyness ±15% and time to maturity 1–12 months in 2009. Furthermore, any trades that are omitted during the data processing because of non-assignable DAX levels, non-determinable trade direction, or unreasonable trade size, are not included. Adapted from Baule & Blonski (forthcoming).

4. The Demand Function

4.1 Unconditional Demand

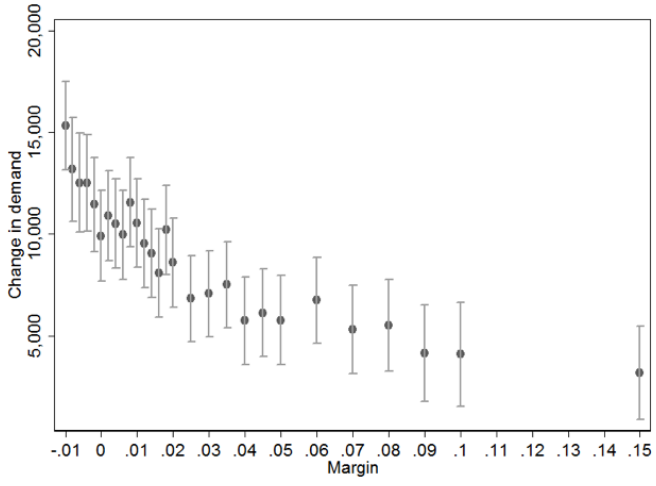
We analyze the demand function, that is, the relationship between the incorporated margin and the demand for a warrant. In order to take the impact of further aspects (like the time to maturity, the moneyness or other factors) into consideration, we do not simply determine demand for different levels of margins but control for such potential factors by running a regression. The regression design reads as follows:[2]

$$\text{Demand}_{i,t} = \sum_{k} \beta_k \, \text{Margininterval}_{k,i,t} + \sum_{j} \gamma_j \, \text{Control}_{j,i,t} + \epsilon_{i,t} \quad (1)$$

where $Demand_{i,t}$ is the total demand for warrant i on day t and $Margininterval_{k,i,t}$ are indicator variables which take the value 1 if warrant i lies in interval k on day t. The margin intervals cover the range from –1% to +15%. The regression coefficients β_k measure differences in demand between different margin intervals for warrants with otherwise identical product properties (identical control variables for strike and time to maturity). Figure 3 illustrates the empirical demand function (i.e., the coefficients for different margin intervals with their standard errors). The reference point for this analysis is the group of the most expensive warrants with a margin larger than 15%. Change in demand is expressed in euro per day.

Figure 3: Unconditional demand function

Notes: The graph shows the daily warrant demand relative to the most expensive warrants (margin > 15%) for different margin intervals (after controlling for a number of influential factors). The vertical bars indicate standard errors of the estimates. Demand decreases sharply with margins up to 2%, whereas the decrease becomes less steep for higher margins.

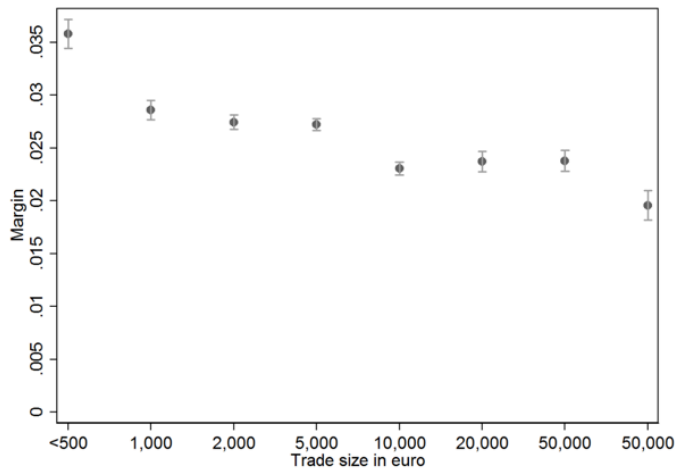


It becomes obvious that products with lower margins indeed attract more demand. For warrants with margins between 0% and 4% (the most common margin-range) an increase of margins by one percentage point leads to a decrease in demand of about 1,500 euro per day. This magnitude is quite remarkable, especially when considering the average trading volume of about 4,000 euro per day and warrant.[3] The decreasing shape resembles a classical convex demand function. The decrease in demand is rather steep for margins of up to 1.5%. Above this level, the function becomes flatter.

4.2 Realized Margins by Order Size

After confirming a general price sensitivity of retail warrant investors, we additionally differentiate between larger and smaller investors. According to previous literature (for an overview see e.g. Barber and Odean, 2013), larger investors should act more rationally and professionally and should thus be able to realize smaller margins. Furthermore, given the fixed information costs for a margin analysis, such an analysis is more rewarding for larger trades than for smaller ones. We thus assume that, on average, larger trades are realized at lower margins than smaller trades. Figure 4 shows the magnitude of realized margins by order size. It becomes obvious that larger investors indeed pay lower margins on average. While trades of up to 500 euro are realized with margins of about 3.6%, trades with an order size of 10,000 euro are realized with margins of about 2.3% and trades with an order size larger than 50,000 euro are realized with margins of slightly below 2%.

Figure 4: Realized margins for different trade sizes



Notes: The graph shows the average unconditionally realized margins for different intervals of order size. The vertical bars indicate standard errors of the estimates.

Summing up the results shown so far, individual investors do invest margin sensitively even though the identification of margins requires no inconsiderable cognitive effort. Furthermore, investors with larger order sizes are more sensitive to margins than investors who invest smaller amounts of money.

4.3 Relative Demand

The analysis hitherto has focused on absolute margins. Following the ideas mentioned above, individual investors should primarily be concerned with comparing similar products. While on the one hand, investors could (for simplification) compare prices of the products with the same properties offered by different issuers, on the other, they could also compare prices of products with (slightly) differing features issued by the same bank.

Thus, if investors compare margins between issuers, we hypothesize that demand would decrease for a specific product if a cheaper competing product with the same product characteristics were available. If investors compare margins of similar products of the same issuer, we hypothesize that demand for a specific product would decrease if a cheaper comparable product were available.

We operationalize our investigation by always focusing on the cheapest alternative product available from the perspective of the investor – either the cheapest warrant offered by another issuer or the cheapest similar warrant offered by the same issuer. We define "similar" products as those with a deviation in the strike price of maximal 50 to 100 basis points. (For the sake of brevity we thus neglect the time to maturity and focus purely on the strike.) In order to measure relative demand, we calculate differences in margins between the warrant in question and the cheapest alternative product. As before, we divide these differences into intervals.

Positive margin differences signify that warrants with lower margins exist. Negative margin differences, on the other hand, imply that the warrant in question is the cheapest available warrant. We thus run the following regression model:[4]

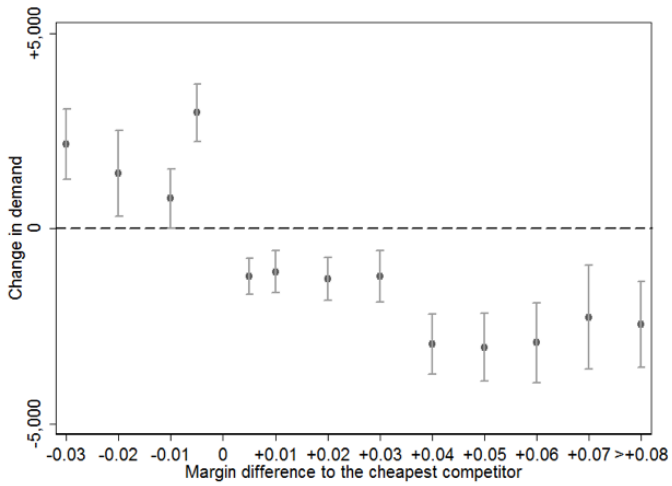
$$Demand_{i,t} = \sum_{k} \beta_{1,k}\, MargindifferenceBanks_{k,i,t} + \sum_{k} \beta_{2,k}\, MargindifferenceStrike_{k,i,t} + \sum_{j} \gamma_j\, Controls_{j,i,t} + \epsilon_{i,t} \quad (2)$$

$MargindifferenceBanks_{k,i,t}$ are 13 indicator variables which represent the intervals of margin differences to the respective cheapest bank from –3% to > +8%. They take the value 1 if warrant i lies in margin-difference interval k on day t. Analogously, $MargindifferenceStrike_{k,i,t}$ are 13 other indicator variables which represent intervals of margin-differences to the warrant with the lowest margin which exhibits similar product characteristics and is issued by the same bank.

Figures 5 and 6 illustrate the average change in demand subject to differences in margins to the cheapest bank, or, the cheapest warrant of the same bank with a similar strike, respectively (measured by the regression coefficients $\beta_{1,k}$ and $\beta_{2,k}$. We obtain relative margin-difference functions which show the differences in margins (i) relative to the cheapest competitor and (ii) relative to the cheapest warrant with similar product properties. The reference points of these analyses are formed by warrants with margin differences of 0%.

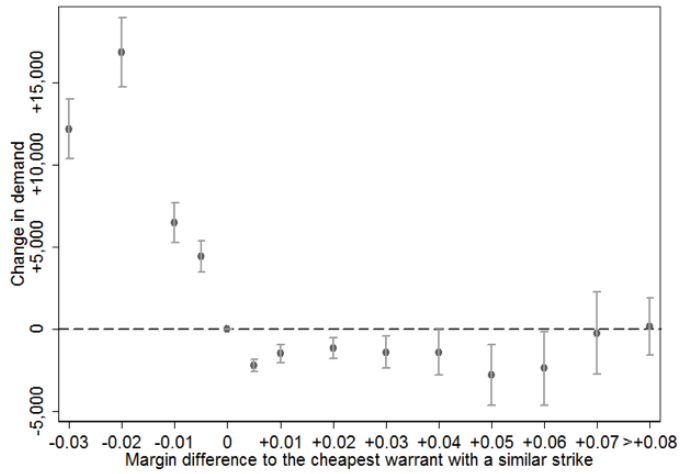
Figure 5 illustrates investors' willingness to leave a certain bank and to go to another institute in order to realize lower margins. In line with our results on unconditional demand, the demand for a certain product is significantly higher if it is the product with the lowest margin. It is interesting to note, however, that the magnitude of the difference in margins is relatively unimportant. If a certain product is the cheapest one available, demand increases ceteris paribus by approximately 2,000 euro. If, however, a competitor offers a cheaper product, demand decreases by approximately 2,000 euro.

Figure 5: Demand function relative to the margin of competing banks



Notes: The graph shows differences in demand with respect to the cheapest competing bank offering an identical warrant, depending on the margin difference to this particular warrant (after controlling for a number of influential factors). The vertical bars indicate standard errors of the estimates.

Figure 6: Demand function relative to the margin of similar products.



Notes: The graph shows differences in demand with respect to the cheapest similar product of the same bank, depending on the margin difference to this particular warrant (after controlling for a number of influential factors). The vertical bars indicate standard errors of the estimates.

Investigation findings for different warrants issued by the same bank are quite similar. Figure 6 illustrates that demand for a certain warrant is dramatically higher (by up to 15,000 euro per day), if the same bank does not offer any cheaper comparable product. These results show that the decrease in demand is particularly huge if a cheaper competitor's product or a similar product is available. The actual magnitude of the margin, however, is not very important. For a margin difference slightly above 0%, demand drops immediately and remains basically stable with increasing margin differences. These findings suggest that investors follow the "majority of confirming dimensions" heuristic of Russo and Dosher (1983). According to this heuristic, investors primarily judge whether a certain product is cheap or expensive relative to another product. They do not, however, incorporate the actual magnitude of the margin into their investment decision.

5. Conclusion

Despite recent literature characterizing individual investors as noise traders, we can show for the warrants market that these private investors do have cognitive abilities which allow them to invest price sensitively, or, margin sensitively. This conclusion is based on the demand function, which exhibits a convex decreasing shape, depending on the margin. Looking more closely at the demand function, we find that it is not the absolute margin that matters, but the margin difference to similar products. Investors compare margins or prices of related products offered by the same bank and by competitors. Demand for a warrant is particularly high when there is no cheaper comparable product. Furthermore, price sensitivity increases with investor size: Larger investors realize lower margins than smaller investors.

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Note

1. Parts of this article are based on Baule & Blonski (2012), Blonski (2014), Baule & Blonski (2015), and Baule and Blonski (forthcoming).
2. For more details see Baule & Blonski (forthcoming).
3. Warrants with a margin close to 0% have a demand which is about 5,000 to 10,000 euro higher than the most expensive warrants with a margin of about 15%. This value seems rather high relative to the average daily trading volume. However, this value is a ceteris paribus value—warrants with very large margins usually are out-of-the-money and exhibit short times to maturity, which causes the control variables to take on completely different values.
4. For more details see Baule & Blonski (forthcoming).

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