JOURNAL OF FINANCIAL AND QUANTITATIVE ANALYSIS Vol. 44, No. 1, Feb. 2009, pp. 85–108
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doi:10.1017/S0022109009090024

https://doi.org/10.1017/S0022109009090024 Published online by Cambridge University Press

Does Sentiment Drive the Retail Demand for IPOs?

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Abstract

Individual and institutional investors can trade German initial public equity offerings on an as-if/when-issued basis before the start of secondary trading. Using actual when-issued trades made by a sample of clients at a large German retail broker during 1999 and 2000, the paper documents that retail buyers consistently overpay for initial public offerings (IPOs) in the when-issued market relative to the immediate aftermarket. The observed willingness to overpay points to sentiment as a driver of retail trading decisions. Consistent with this interpretation and with sentiment affecting prices, IPOs that are aggressively bought by individuals in the when-issued market exhibit high first-day returns as well as poor aftermarket returns relative to benchmarks of similar stocks.

I. Introduction

Investors who trade on sentiment, understood as beliefs about asset values unwarranted by fundamentals, are an important ingredient of models of noise trading and style investing as outlined, e.g., by DeLong, Shleifer, Summers, and Waldmann (1990a) and Barberis and Shleifer (2003). In the presence of short-sale constraints, another essential ingredient of such models, the beliefs of sentiment investors can affect prices and resource allocation.

Beliefs of sentiment investors may matter in IPOs, in particular, because IPOs are initially costly to sell short (Geczy, Musto, and Reed (2002)). Besides the higher direct cost of short-selling IPOs relative to other stocks (D'Avolio (2002)),

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the underwriter's threat to withhold future hot IPO allocations imposes an indirect cost on potential sellers or even nonbuyers in the aftermarket (Griffin, Harris, and Topaloglu (2007)).

Derrien (2005) and Ljungqvist, Nanda, and Singh (2006) theoretically explore IPO pricing and aftermarket returns in the presence of overoptimistic investors and short-sale constraints. The models in these papers suggest that individual investor sentiment can help explain both the severe underpricing and the poor aftermarket performance of many IPOs in the late 1990s (Ritter and Welch (2002)).

Empirically, however, investor sentiment is hard to identify because both beliefs and fundamental values are unobservable. Researchers thus have to rely on proxies such as closed-end fund discounts (Lowry (2003)), the absence of block trades (Ofek and Richardson (2003)), or retail applications during book-building (Derrien (2005)) to identify sentiment.

This paper proposes a novel way of identifying individual investor sentiment in the German IPO market where investors can trade IPOs on an as-if/when-issued (WI) basis already during the book-building period (i.e., before the start of secondary market trading).[1]

Using a proprietary data set of WI trades of clients at a German retail broker (one of the three largest discount brokers in Europe) between August 1999 and May 2000, I infer individual investor sentiment from the fact that retail buyers in the WI market pay a hefty premium relative to prices in the immediate aftermarket. The median return from buying at a WI price actually paid by a sample investor and selling in the first secondary market auction is -13% before trading commissions. Using publicly available WI data for the period from June 2000 to April 2001, I document that the WI premium is not an artifact of the sample period during which I observe individual transactions. The willingness to pay WI prices that are consistently higher than prices in the immediate aftermarket cannot be explained by an inability to get shares in the aftermarket, higher trading costs in the aftermarket, or rational beliefs that the shares can be sold at a profit to a "greater fool" in the WI market.

The fact that retail buyers consistently overpay in the WI market suggests that at least some retail investors are subject to sentiment. Moreover, I document that IPOs that are aggressively bought by retail investors in the WI market, controlling for variables such as firm size and past industry returns, are also sought after by retail investors in the aftermarket, other things being equal. Thus, the sentiment of retail investors in the WI market appears to be representative of the broader population of retail investors in the aftermarket.

To examine whether retail sentiment pushes aftermarket prices above fundamental values, I use the observed propensity to buy in the WI market or on the IPO day as a proxy for sentiment. Consistent with the conjecture that sentiment affects prices, retail WI purchases are positively associated with underpricing,

[1] In other respects, the German IPO market is quite similar to the U.S. market. For example, most companies go public using a pure book-building mechanism, giving the underwriter full discretion over how to allocate shares. Ritter (2003) and Jenkinson, Morrison, and Wilhelm (2006) provide details on similarities of and differences between U.S. and European IPO markets.

https://doi.org/10.1017/S0022109009090024 Published online by Cambridge University Press

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controlling for a range of IPO offer and market characteristics. Moreover, IPOs especially sought after by retail investors in the WI market, or the aftermarket, experience longer-run returns that are systematically below returns of the broad stock market, same-industry stocks, stocks with similar size and market-to-book (MTB) characteristics, and IPOs that are shunned by retail investors. For example, a one-standard deviation increase in retail IPO purchases is associated with a return of 27% below an industry-matched portfolio during the first six months after the IPO, controlling for firm size, MTB ratio, and firm industry.

The papers most closely related to this study are Löffler, Panther, and Theissen (2005) and Aussenegg, Pichler, and Stomper (2006) as well as the empirical work in Derrien (2005) and Cornelli, Goldreich, and Ljungqvist (2006).

At first glance, the results in this paper appear to be at odds with Löffler et al. (2005), who also study the German WI market and report, "Pre-IPO prices [. . .] appear to be largely unbiased estimates of the subsequent exchange prices" (p. 467). The different results are due to differences in methodology: Löffler et al. (2005) rely on the midpoint of the bid-ask spread quoted by a leading WI market maker at the close of the final day of WI trading, whereas I use transaction prices to estimate the performance of retail investors. My results suggest that the midpoint of the last WI quote is a poor proxy for actual WI prices paid by retail buyers—partly because WI spreads are wide and partly because last-day WI spreads are not representative of spreads quoted during the remainder of the WI market.

Aussenegg et al. (2006) examine the relation between WI prices, IPO prices in the primary market, and underpricing. The authors report that WI prices reflect information revealed by informed investors prior to book building, and that this information is only partially reflected in IPO offer prices (Weiss (1993), Jenkinson et al. (2006)). However, Aussenegg et al. (2006) are silent on whether this information is about fundamentals or sentiment—the focus of this paper.

The empirical work in Derrien (2005) and Cornelli et al. (2006) is similar in that the two papers relate proxies for sentiment—retail applications during book building in Derrien, and the relation between WI prices and the offer price range in Cornelli et al. (2006)—to aftermarket returns. However, the validity of these proxies rests on their negative correlation with aftermarket returns; the relation between the proxies and the beliefs or actions of the investors suspected of sentiment is unclear. In fact, Derrien (2005) acknowledges that retail applications during book building cannot be classified as irrational in his sample.[2] By themselves, high WI prices relative to the offer price range need not signal retail sentiment either, but could point to a partial adjustment to information revealed before bookbuilding (Aussenegg et al. (2006), Jenkinson et al. (2006)). By contrast, the

[2]Derrien (2005) notes that a strategy that effectively mimics the behavior of his retail investors during book-building would have been profitable, at least ex-post: "In unreported calculations, I find that an individual investor who bid for the maximum number of shares allowed in all IPOs occurring in the third tercile of market conditions gained approximately 10% after realistic fees of seven euros per transaction, if she flipped her shares at the offer price on the first trading day. This number is far below the average initial return of these IPOs due to rationing and transaction fees, but it is still a substantial one-day return. Individual investors, though they are presumably uninformed, may be rational" (pp. 514–515).

validity of retail WI purchases as a proxy for sentiment is not based on long-run returns. That such purchases are negatively correlated with long-run returns suggests that it is indeed retail sentiment that drives prices above fundamental values.

The remainder of the paper proceeds as follows: Section II is a description of the sample IPOs and brokerage transaction records. Section III introduces the essential features of the WI market in equity IPOs listing on German stock exchanges. Section IV documents that retail buyers systematically overpay in the WI market. Section V examines whether retail sentiment, proxied by retail purchases in the WI market and on the day of the IPO, temporarily pushes prices above fundamental values. Section VI concludes.

II. Data

A. Brokerage Transaction Data

The analysis in this paper draws on proprietary daily transaction records of a large sample of clients at a German retail broker. The broker, a subsidiary of a German universal bank, is one of Europe's three largest brokers in the discount segment both by the number of clients and the value of client deposits throughout the sample period. The broker is labeled as a discount broker because no investment advice is given. Although stocks are not recommended explicitly, the broker may act as a selling agent or junior syndicate member in IPOs underwritten by its parent bank and other affiliated banks. In such cases, the broker prominently displays the IPOs on its Web site, which could be interpreted as an endorsement even if no explicit recommendation is given.

The client sample of about 37,000 clients was drawn randomly from the entire active and former client population in January 1999. The sample represents roughly half of the existing client population at that time. Complete daily transaction records as well as opening positions are available for all clients in the sample even if they close their account before or during the sample period; between August 1999 and May 2000, the average number of active clients was 33,000.[3]

The transaction data set used in this paper encompasses all the stock trades made from the date the account was opened until the date the account was closed or May 31, 2000, whichever comes first. The typical transaction record consists of a unique identification number, an account number, a transaction date, a buy/sell indicator, a security identification code, the number of shares traded, the gross transaction value, the transaction fees, and an exchange code identifying where the order is placed (e.g., the floor of the Frankfurt Stock Exchange). The exchange code makes it possible to unambiguously classify primary market transactions (shares allocated to retail clients who applied for shares during the book-building process), WI trades, and secondary market trades.

The sample of clients is, if only by virtue of its size, fairly representative of the population of German discount or online brokerage clients; as of January

[3]"Active" here just means that the client account is open as opposed to closed. An active client need not be trading during the sample period.

https://doi.org/10.1017/S0022109009090024 Published online by Cambridge University Press

1999, it represented 10% of the total number of accounts held at German discount brokers (Van Steenis and Ossig (2000)). In turn, discount brokerage clients constitute a substantial fraction of the German retail investor population. As of May 2000, there were 1.6 million accounts held at German discount brokers (Van Steenis and Ossig (2000)) relative to roughly 6.2 million German investors with any exposure to individual stocks at the end of 2000 (Deutsches Aktieninstitut (2003)).

B. Sample IPOs

The paper focuses on IPOs that can, in principle, be traded in the WI market by the sample investors. To be eligible for WI trading through the broker, a firm has to go public after August 1, 1999, list on either the Regulated Official Market (Amtlicher Handel) segment or the Neuer Markt segment of the Frankfurt Stock Exchange, and use the book-building procedure to go public; these conditions are imposed by the terms of the cooperation between the retail broker and the WI market maker to whom the brokerage order flow is routed. More than 90% of all IPOs meet these requirements during the sample period from August 1999 to May 2000 (the sample period is limited by the availability of transactions data). A few smaller IPOs list on the Regulated Unofficial Market segment of the Frankfurt Stock Exchange (Freiverkehr) because they are unable or unwilling to meet the more stringent listing criteria of the Regulated Official Market or Neuer Markt segments. To comply with insider trading and price manipulation laws, detailed below in Section III, the retail broker bars its clients from participating in the WI market of IPOs that are sold or underwritten either by the broker itself, the broker's parent (the universal bank), or affiliated banks (for whom the broker has agreed to collect orders in the primary market and distribute allocations). Unlike purchases of shares in the primary market (i.e., applications for shares during book building), WI purchases are not subject to the discretion of the underwriter or issuer; in principle, all retail investors can buy shares in the WI market.

The main sample consists of 127 IPOs that list on the Regulated Official Market or the Neuer Markt segment of the Frankfurt Stock Exchange between August 1, 1999 and May 31, 2000, and all but one of the firms use the book-building mechanism to go public. Out of the 126 remaining IPOs, 35 IPOs drop out of the sample because they are underwritten by the broker, its parent, or affiliated institutions and thus ineligible for WI trading by the sample investors—the broker's parent bank is among the most active underwriters on the Neuer Market during the sample period.

Table 1 compares the 91 sample IPOs with the 36 other IPOs; the IPO data are hand-collected from the offering prospectuses and checked against as well as complemented by data available on the Web site of Deutsche Börse under the heading "Primary Market Statistics."[4] Univariate firm and deal characteristics do not differ much between the two samples. The nonsample IPOs are slightly

[4]Prospectuses are missing for six IPOs. For all but one IPO, the data could be reconstructed from the annual reports for the IPO year and Deutsche Börse statistics.

https://doi.org/10.1017/S0022109009090024 Published online by Cambridge University Press

larger, on average, because the sample of other IPOs includes two outliers—the IPOs of Infineon and T-Online dwarf all other 124 IPOs—which also explains the large difference between the mean and median firm size of the nonsample IPOs. Most of the firms that go public during the sample period, especially toward the end of the sample period, choose to list on the Neuer Markt. The Neuer Markt, founded in March 1997, caters to growth and technology stocks; about two thirds of the IPOs can be classified either as Internet or as high-tech firms.[5]

TABLE 1

Summary Statistics of IPO Sample

The combined sample of 127 IPOs represents IPOs of companies that list in the Regulated Official Market or the Neuer Market segment of the Frankfurt Stock Exchange during the period from August 1999 to May 2000. Summary statistics are reported separately for the subsample of 91 IPOs in which the brokerage clients participate in when-issued (WI) trading and the subsample of the remaining IPOs. The IPO characteristics are computed using the most recent financial statements available from the IPO prospectus or annual report. Market capitalization is the total number of shares outstanding after the IPO times the midpoint of the filing range. Market-to-book (MTB) value is the market capitalization divided by the book value of equity (which includes proceeds from the IPO valued at the midpoint of the filing range) minus the book value of intangible assets. Firms are classified as Internet firms if their Datastream industry code is either 5250 (Retailers E-Commerce) or 9740 (Internet). Firms are classified as high-tech firms if their industry code is 5430 (Cable + Satellite), 1160 (Chemicals, Advanced Materials), 9720 (Computer Services), 9320 (Computer Hardware), 2530 (Electronic Equipment), 9360 (Semiconductors), 9770 (Software), 9380 (Telecom Equipment), 6730 (Telecom Fixed Line), or 6780 (Telecom Wireless). Venture Capital (VC) backing is broadly defined as the presence of a financial investor at the time of the IPO, as noted in the offering prospectus. Underpricing is the first aftermarket price divided by the offer price minus one. During the sample period, 1 Deutsche Mark (DEM) corresponds to roughly 0.5 U.S. dollars. ***, **, and * indicate whether the means or proportions of the characteristics differ significantly between the two groups at the 1%, 5%, and 10% levels, respectively.

	WI Sample		Other IPOs		
Characteristics	Mean	Median	Mean	Median	Difference in Means or Proportions
Number of IPOs	91		36		
Panel A. Firm Characteristics					
Firm age at IPO (years)	10	7	14	9	
Market capitalization (DEM million)	499	281	2,580	336	**
MTB value	3.8	3.7	4.4	3.7	
Fraction of Internet firms	24%		17%		
Fraction of high-tech firms	38%		53%		
Fraction of domestic firms	87%		64%		***
Panel B. Deal Characteristics					
Fraction listing on the Neuer Markt	95%		92%		
Fraction of firms with VC backing	33%		29%		
Length of bookbuilding period (days)	5	4	6	4	*
Width of bookbuilding range	17%	17%	18%	18%	
Number of syndicate members	3	3	4	3	
Underpricing	50%	19%	54%	15%	

To extend the analysis beyond the sample period for which individual trading records are available, I collect daily WI transaction price ranges and trading volume for a second sample of IPOs—89 IPOs that go public between June 2000 and April 2001 (the German IPO market virtually dried up after that period). This data is made available by Schnigge AG, a leading WI market maker, and published daily in the *Börsen-Zeitung*—the official publication of the German Stock Exchanges—from June 2000 onward.

[5]The Neuer Markt was formally closed in 2003, partly due to the performance of the technology sector after 2000. However, this was a mostly cosmetic change, as Neuer Markt firms were absorbed by existing segments of the Frankfurt Stock Exchange.

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III. Essential Features of the WI Market

Individual and institutional investors can trade new equity issues to be listed on German stock exchanges in a WI market before the start of secondary market trading. WI trades are forward trades in which the seller promises to deliver IPO shares in exchange for being paid the prevailing price in the WI market. WI trading starts on the same day as the book building period (i.e., after the preliminary prospectus has been published and the filing range has been released) and lasts until the trading day before the IPO. WI trading can take place after the offer price has been set if one or more trading days elapse between the pricing of the issue and the IPO. The typical WI trading period lasts about a week.

WI markets are organized by independent market makers who specialize in after-hours trading and liquidity provision in Neuer Markt stocks. Between 1999 and 2000, the number of WI market makers increased from one to three. During the sample period, there were two WI market makers, Schnigge and Lang and Schwarz. Schnigge claims to account for 80% of the WI trading volume.[6] In 1999, Lang and Schwarz, entered the fray with an electronic WI platform allowing individual investors to place their orders through a discount broker either online or over the phone. In 2000, after the sample period, the Berliner Effektengesellschaft introduced a second electronic WI platform open to individual investors through several retail brokers.

A unique feature of the WI market is that for any trading to occur, institutions need to go net short; retail investors are de facto restricted from shorting WI shares, although they can sell WI shares that they have previously purchased.[7] Moreover, to avoid the semblance of enabling insider trading or trying to manipulate prices, brokers and WI market makers restrict participation in the WI market to accounts held at banks that are not members of the underwriting syndicate.

Column (1) of Table 2 characterizes the WI trades of the individual investor sample (August 1999–May 2000). Columns (2) and (3) provide a comparison with secondary market trades of IPOs during the first month after the IPO, and Column (4) characterizes trades in shares of German companies that did not go public during the sample period. Given that retail investors cannot short shares, one would expect purchases of IPOs to outnumber sales during the WI market and the beginning of the secondary market. Panel A of Table 2 shows that 19 out of 20 transactions in the WI market are purchases, i.e., only a small fraction of retail investors participate as sellers in the WI market by unwinding their previously established long positions.

The days surrounding IPOs are characterized by aggressive retail buying. During a WI trading day, the sample investors purchase 0.01% of the company's

[6] See Schnigge's *1999 Annual Report* at http://www.schnigge.de/var/99gb000602.pdf, last viewed April 14, 2002.

[7] During the sample period, none of the major German retail brokers enable their clients to short stocks. The brokers point to the unlimited downside risk associated with short selling and the resulting threat of legal action by retail clients; according to paragraph 37d of the German Securities Trading Act, a broker can be liable for damages arising from certain transactions if the broker fails to fully disclose the risks associated with the transaction—see also the May 24, 2002, Internet edition of the *Frankfurter Allgemeine Zeitung*, a national daily newspaper, at http://www.faz.net, "Leerverkäufe—leichter gesagt als getan" (Short-selling—easier said than done), last viewed August 15, 2002.

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TABLE 2

Summary Statistics of WI and Aftermarket Trades

Table 2 compares the trade characteristics and daily trading activity of the brokerage sample in the 91 sample IPOs in the WI market (Column (1)), on the day of the IPO (Column (2)), and during the remainder of the first month after the IPO (Column (3)). Column (4) contains sample period statistics for trades in 550 German stocks that listed before the sample period.

	(1) WI Trades	(2) Post-IPO Trades Day 1	(3) Post-IPO Trades Days 2–27	(4) Non-IPO Trades Aug 1999–May 2000
Panel A. Aggregate Statistics				
Number of transactions	1,839	3,448	14,939	186,935
Thereof: purchases	95%	86%	60%	51%
Number of different traders	874	1,718	4,589	21,587
Number of different stocks	91	90	90	550
Absolute daily net trades to firm size				
Mean	0.010%	0.100%	0.010%	0.002%
Median	0.007%	0.006%	0.007%	0.000%
Panel B. Trade Statistics				
Mean trade size (DEM)	8,200	11,500	9,800	11,200
Mean one-way commission	0.9%	0.9%	0.9%	0.9%
Median holding period (days)	25	15	20	49

market capitalization implied by the midpoint of the book building range, on average; net purchases peak on the day of the IPO with average net purchases of 0.1% and decline during the remainder of the first month to 0.01% of the implied market capitalization. By contrast, the absolute value of daily net purchases or sales of non-IPO stocks averages only 0.002% of the stocks' market capitalization during the sample period.

Data on market-wide WI trading volume is not publicly available. However, during the period June 2000 to April 2001, the leading WI market maker Schnigge reports handling a total trading volume of Deutsche Mark (DEM) 400 million (corresponding to roughly 200 million U.S. dollars). The average ratio of the number of shares traded through Schnigge during the WI market of an IPO to the number of shares to be sold is 2.7%, which corresponds to a daily ratio of 0.4%—much lower than the typical volume during the day of the IPO, but similar to the daily trading volume of a typical German stock.

Although WI purchases tend to be slightly smaller than purchases in the secondary market (see Panel B of Table 2), they are sizable relative to the typical portfolio of stocks and mutual funds held by the retail investors. The position established in the WI market typically represents 15% of the stock and fund portfolio of a WI participant. Panel B of Table 2 also shows that purchases of IPOs, both in the WI market and during the first month after the IPO, are short-term bets. Shares purchased in the WI market are typically held 25 calendar days; in contrast, the typical holding period of a German non-IPO stock during the sample period is 50 days.

IV. Retail Performance in the WI Market

The setup of the German WI market—individual investors trading against market makers and presumably sophisticated institutional investors—invites the question of how individual investors fare in WI trading.

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A. Retail WI Purchases Perform Poorly

1. In-Sample WI Returns

The WI return, $r^{WI}_{i,j,t}$, defined as sample investor i's return from buying IPO j on day t at the WI price recorded in the transaction database, $P^{WI}_{i,j,t}$, and selling at the price established in the first auction on Xetra (the electronic limit order book of the Frankfurt Stock Exchange) on the day of the IPO, P^{open}_{j},

$$r^{WI}_{i,j,t} = \frac{P^{open}_{j}}{P^{WI}_{i,j,t}} - 1 \tag{1}$$

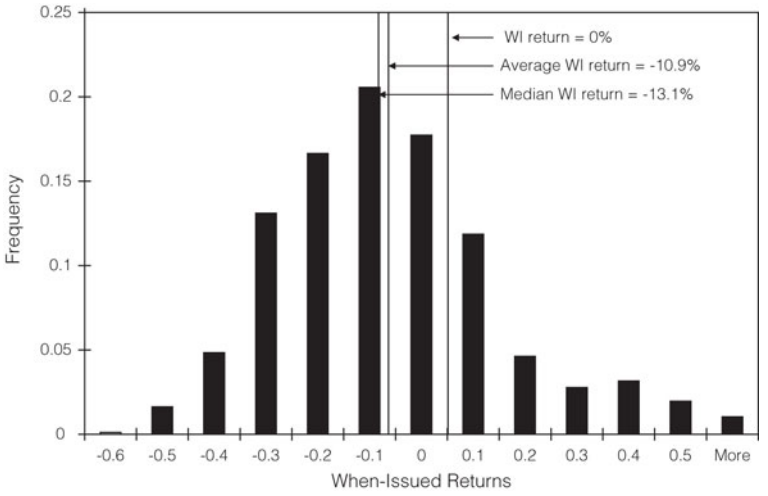
is a natural measure for the performance of retail WI purchases—WI trading occurs just a few days before the start of the secondary market, and shares purchased in the WI market are delivered to the buyer in the same way as shares purchased on the first day of the secondary market (they are booked into the buyer's account two business days after the IPO). Note that the trading strategy corresponding to the WI return is feasible; the clients can specify explicitly that their order be executed in the opening auction.

The striking result is that more than three out of four WI purchases are made at a price at or above the first price established in aftermarket trading. Figure 1 shows the distribution of WI returns; the equally-weighted average and median WI returns, calculated across all purchases in the sample between August 1999 and May 2000, are −11% and −13%, an abysmal performance considering that this performance is measured over just a few days and that WI returns are calculated before trading commissions.

FIGURE 1

Distribution of Hypothetical Returns of WI Purchases

For each purchase in the WI market, the hypothetical WI return is calculated as the return from buying at the actual price recorded in the transaction database and selling at the first aftermarket price. The (equally-weighted) average and median WI returns are calculated across all WI purchases in the sample.



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Negative WI returns are not driven by small trades; the trade value-weighted average return across all purchases is similar to the equally-weighted average. Poor WI returns are not concentrated in a few IPOs either; in more than four out of five IPOs, the average price of WI purchases exceeds the first aftermarket price. Using day 1 closing prices instead of day 1 opening prices to calculate WI returns yields similar results. Median WI returns are -12% before trading costs. To address the concern that retail clients may expect to be unable to trade at either the opening or the closing price in the aftermarket—although they can explicitly submit an order to be executed at either price—I repeat the calculations using the median actual transaction price observed within the brokerage; the median WI return is lower than -11% before trading costs.

To judge the statistical significance of WI trading performance and deal with potential cross-sectional dependence of WI returns due to overlapping WI trading periods, I construct a time series of daily returns of WI purchases across the sample IPOs as follows. Since none of the WI market makers makes closing prices publicly available, I calculate a WI price for IPO j on day t by averaging across all purchase prices paid for j's shares by the brokerage clients that day,

$$\overline{P}_{\mathrm{WI},j,t} = \frac{1}{N}\sum_{i=1}^{N} P_{i,j,t}^{\mathrm{WI}}, \tag{2}$$

where N is the number of buyers in the sample. The daily WI return in IPO j for day t is then defined as

$$r_{j,t}^{\mathrm{WI}} = \frac{\overline{P}_{\mathrm{WI},j,t}}{\overline{P}_{\mathrm{WI},j,t-1}} - 1. \tag{3}$$

To calculate the WI return between the last day of WI trading and the opening day, $\overline{P}_{\mathrm{WI},j,t}$ is replaced by $P_{j,\mathrm{open}}$. The price $P_{j,\mathrm{open}}$ is the result of the opening auction and based on the principle of highest volume transacted. If there is no trading in an IPO on a given day by the sample of brokerage clients, I set the WI return equal to zero for that day; however, days without participation by the sample investors account for less than 2% of possible trading days.[8] On days when multiple IPOs are traded in the WI market, the daily WI return is calculated as an equally- or value-weighted average of the individual WI returns; IPOs are value-weighted by their offering size computed at the midpoint of the filing range. Daily excess WI returns are computed by subtracting one of two benchmark returns—the returns of a value-weighted index of the 100 largest and most liquid German stocks (the Dax 100), and a value-weighted index of the 50 largest and most liquid growth and technology stocks listing on the Neuer Markt (the Nemax 50)—from the time series of WI returns. On days without any activity in the IPO market—no brokerage activity or no overall IPO market activity—daily excess WI returns are set to zero.

[8]This assumption does not affect the estimate of the mean of the time series, and the inferences in the paper are robust to alternative assumptions such as randomly drawing a daily return from a normal distribution with mean zero and standard deviation equal to the sample standard deviation of available WI returns.

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Panel A of Table 3 reports equally-weighted average daily WI returns, both raw and in excess of the Dax 100 and the Nemax 50. During the entire sample period, the portfolio of WI shares lags its benchmarks by about 1.6% per day, regardless of the benchmark chosen. The null hypothesis that daily excess WI returns are zero is rejected at the 1% level. Put differently, a trading strategy consisting of putting DEM 100 into an equally-weighted portfolio of WI shares would have left an investor with less than DEM 5 before trading commissions 10 months later, at the end of the sample period.

TABLE 3

In-Sample WI Returns

Table 3 summarizes daily when-issued (WI) returns for 91 firms that went public during the 212 trading days between August 1, 1999 and May 31, 2000. The bold-faced entries in the first row are average daily returns, the second row reports standard deviations of the daily returns or excess returns, and the third row reports the *p*-values for the null hypothesis that average daily returns are zero (assuming independence of (excess) returns over time). The equally-weighted average returns reported in Panel A assume that on any given day, the investor holds an equal stake in all of the IPOs then trading in the WI market. The value-weighted average returns reported in Panel B assume that on any given day, the investor weights his WI share holdings in proportion to the IPO's market capitalization based on the midpoint of the filing range. Column (1) reports raw returns, Column (2) reports raw returns in excess of the Dax 100, and Column (3) reports returns in excess of the Nemax 50. The results "Only last WI return" are based on the hypothetical return from buying on the last day of the WI market at the average WI purchase price observed that day and selling at the first price established in the opening auction on the Frankfurt Stock Exchange. The number of observations in the "Only last WI return" is lower than the number of IPOs because a few IPOs list on the same day—in this case, the last return for that day is the equally-weighted average return.

				Returns in Excess of	
	No. of Obs.	Statistic	Raw Returns	Dax 100	Nemax 50
Panel A. Equally-Weighted (EW) Average Daily Returns					
All	212	Mean	**−1.5%**	**−1.6%**	**−1.6%**
		Std	7.2%	7.3%	7.6%
		p-value	0.004	0.002	0.003
Aug 1999–Dec 2000	108	Mean	**−1.2%**	**−1.4%**	**−1.4%**
		Std	5.9%	5.6%	5.7%
		p-value	0.029	0.010	0.010
Jan 2000–May 2000	104	Mean	**−1.7%**	**−1.7%**	**−1.7%**
		Std	8.4%	8.7%	9.1%
		p-value	0.044	0.047	0.063
Only last WI return	72	Mean	**−7.3%**		
		Std	17.8%		
		p-value	0.002		
Panel B. Value-Weighted (VW) Average Daily Returns					
All	212	Mean	**−1.6%**	**−1.6%**	**−1.7%**
		Std	7.8%	7.8%	8.0%
		p-value	0.004	0.002	0.003

To address the concern that the poor performance of retail WI purchases is concentrated at the beginning of the sample but disappears as retail traders learn to avoid paying high WI prices, I consider the two subperiods August–December 1999 and January–May 2000; if anything, investments in the WI market fare worse during the latter subperiod, with a daily return of 1.7% below the benchmarks.

For most IPOs, the bulk of the poor performance of WI shares is realized at the end of WI trading. On average, the last WI return measured from the last recorded WI purchase price to the aftermarket price is −7.3%. When the last WI return is omitted, average WI returns are still negative but less significant in statistical and economic terms. For example, equally-weighted average WI returns in excess of the Nemax 50 are −0.4% per day, which is not significantly different from zero. A reduction in the market maker's spread during the WI period might

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explain why WI purchase prices decline during the WI period; as trades of market participants reveal information to the market maker, initial information asymmetries and the adverse selection component of the spread are reduced.[9]

These results are not driven by small firms. Panel B of Table 3 shows similar results when raw and excess WI returns are value-weighted instead of equally-weighted.

2. Out-of-Sample WI Returns

Clearly, the sample period is unusual; the growth and technology stocks included in the Nemax 50 posted returns of 70% between August 1999 and May 2000. By contrast, the Nemax 50 fell by 70% between June 2000 and April 2001. Therefore, one might be concerned that the documented WI returns are somehow a by-product of the stock market run-up during the late 1990s. Although the sample period ends in May 2000 due to the availability of brokerage trading records, WI returns can be estimated beyond the sample period. During the period from June 2000 to April 2001, the leading WI market maker Schnigge reports daily transaction price ranges and trading volume for 89 IPOs that are traded in the German WI market. Across all IPOs and WI trading days, the transaction price range averages 9% of the transaction price midpoint; by comparison, Löffler et al. (2005) report an average spread between the closing bid and ask on the final day of WI trading of 10% during 2000 and 2001. This suggests that the transaction price range basically captures the WI market maker's wide bid-ask spread.

I construct a daily time series of out-of-sample WI returns by defining the WI return of IPO j on day t as the ratio of the midpoint of the transaction price range on day t to the midpoint of the transaction price range on day $t-1$,

$$r_{j,t}^{\text{WI}}\,(\text{out-of-sample}) = \frac{P_{\text{WI},j,t}^{\max} + P_{\text{WI},j,t}^{\min}}{P_{\text{WI},j,t-1}^{\max} + P_{\text{WI},j,t-1}^{\min}} - 1. \tag{4}$$

To calculate the WI return between the last day of WI trading and the opening day, I use the price from the opening auction in the aftermarket. This definition makes it possible to compare in-sample and out-of-sample returns, since both are based on estimates of average purchase prices. The top of the transaction price range, $P^{\max}$, is presumably the highest price at which investors buy from the WI market maker, and $P^{\min}$ is the lowest price at which investors sell to the WI market maker. Note that this approximation likely underestimates the average purchase price; because of the wide spreads, purchase prices should be closer to the top than to the bottom of the transaction price range.

Panel A of Table 4 presents the results for WI returns—based on the midpoint of the WI transaction price range—between June 2000 and April 2001. The WI returns are similar to those recorded for the main sample (i.e., the earlier period from August 1999 to May 2000). For example, equally-weighted average WI returns lag the Dax 100 by 1.6% per day. The null hypothesis that daily excess WI returns are zero is rejected at the 1% level for all benchmarks. Average WI returns in excess of the Nemax 50, while still significantly negative, are higher because

[9]This explanation was suggested by Norbert Empting, a WI trader at Schnigge.

https://doi.org/10.1017/S0022109009090024 Published online by Cambridge University Press

the growth and technology stocks disproportionately represented in the Nemax 50 were hit harder during the downturn between June 2000 and April 2001. Although WI shares of larger IPOs perform relatively better, value-weighted average WI returns are also negative and highly significant in both statistical and economic terms.

TABLE 4

Out-of-Sample WI Returns

Table 4 summarizes daily when-issued (WI) returns for the 89 firms that went public during the 219 trading days between June 1, 2000 and April 9, 2001 and for whom the WI market maker Schnigge makes available daily transaction price ranges during the WI period. The bold-faced entries in the first row are average daily returns, the second row reports standard deviations of the daily returns or excess returns, and the third row reports the *p*-values for the null hypothesis that average daily returns are zero (assuming independence of (excess) returns over time). The assumption underlying Panel A is that the average purchase price can be approximated by the midpoint of the publicly reported transaction price range. In Panel B, the average purchase price is approximated by the minimum of the publicly reported transaction price range. The equally-weighted average returns assume that on any given day, the investor holds an equal stake in all of the IPOs then trading in the WI market. The value-weighted average returns assume that on any given day, the investor weighs his WI share holdings in proportion to the size of the offering based on the midpoint of the filing range. Column (1) reports raw returns, Column (2) reports raw returns in excess of the Dax 100, and Column (3) reports returns in excess of the Nemax 50. If there are no IPOs in the WI market on a given day, both raw and excess returns are set to zero for that day.

		(1)	(2) Returns in Excess of	(3)
	Statistic	Raw Returns	Dax 100	Nemax 50
Panel A. Purchase Price is Assumed to be the Midpoint of Transaction Price Range on a Given Day				
Equally-weighted average daily returns	Mean	**−1.7%**	**−1.6%**	**−1.2%**
	Std	4.4%	4.3%	4.5%
	p-value	<0.001	<0.001	<0.001
Value-weighted average daily returns	Mean	**−1.3%**	**−1.2%**	**−0.9%**
	Std	4.6%	4.6%	4.7%
	p-value	<0.001	<0.001	0.007
Only last WI return	Mean	**−3.4%**		
	Std	9.9%		
	p-value	0.007		
Panel B. Purchase Price is Assumed to be the Minimum Transaction Price on a Given Day				
Equally-weighted average daily returns	Mean	**−1.1%**	**−1.0%**	**−0.7%**
	Std	5.4%	5.3%	5.4%
	p-value	0.003	0.005	0.071
Value-weighted average daily returns	Mean	**−0.7%**	**−0.6%**	**−0.3%**
	Std	5.6%	5.5%	5.6%
	p-value	0.083	0.106	0.498
Only last WI return	Mean	**2.0%**		
	Std	10.6%		
	p-value	0.112		

Given that information about minimum prices are available, one can ask whether retail investors would have made money had they been able to buy at the minimum transaction price in the WI market. This is a hypothetical question, since the minimum transaction price most likely results from a seller-initiated transaction executed at the bid price. Panel B of Table 4 presents WI return statistics assuming that the average purchase price in a given issue and day is the minimum transaction price reported by the WI market maker Schnigge for that issue-day. Average WI returns are still negative, although the statistical significance depends on the type of average—value-weighted WI returns are no longer significantly different from zero—and the benchmark chosen to calculate excess returns; also, the last WI return is now positive, implying that the minimum WI price on the last WI trading day tends to be below the first aftermarket price.

https://doi.org/10.1017/S0022109009090024 Published online by Cambridge University Press

These results are remarkable not so much because they confirm the robustness of the earlier WI return calculations, but because they suggest the WI market maker's spread as a reason why retail WI buyers consistently overpay,[10] and why institutional sellers apparently fail to exploit the retail WI buyers' willingness to overpay. It appears that the prices at which institutions sell in the WI market are close to aftermarket prices.

Without detailed information on WI prices, volumes, and quotes, it is difficult to determine whether the WI market makers' spreads reflect the cost of providing market making services in an environment with great information asymmetries or simply market power. Wide bid-ask spreads may explain why retail buyers consistently lose in the WI market, but they cannot explain why retail investors are willing to trade in the WI market in the first place. If anything, one would expect the size of the WI spread—both in absolute terms and relative to aftermarket spreads[11]—to discourage participation in the WI market.

B. Determinants of Retail IPO Participation

To examine what drives the variation in retail participation across IPOs, and thereby shed light on what makes retail investors trade in the first place, I regress the logarithm of the aggregate value of all WI purchases firm by firm—and, in a second regression, the logarithm of all day 1 purchases—on firm size as well as other firm attributes and deal characteristics that reflect competing hypotheses about investor behavior. Purchases are a better measure of retail interest than net purchases or trading volume because sales might simply reflect returns during the WI trading period or a high intraday return on the IPO day.

Based on survey responses from individual investors who had previously participated in IPOs, Shiller (1988) outlines the certification hypothesis and the impresario hypothesis of retail interest in IPOs. According to the certification hypothesis, investors make their decision of whether or not to invest in an IPO contingent on the quality of the underwriter—investors are aware of information asymmetries between themselves and the issuer, and rely on the underwriter to certify the issuer's quality.[12] The underwriter's market share can be a proxy for his ability to certify an issue (Megginson and Weiss (1991)). A given bank's market share in my sample is the combined issue volume—evaluated at the midpoint of the filing range—underwritten by that bank as a fraction of the aggregate issue volume of German IPOs between 1997 and July 1999.

[10] In principle, high WI purchase prices could also reflect the risk that WI buyers—primarily retail investors—default on their obligation to put up the cash necessary to settle the purchase with the WI market maker. In practice, however, this risk is eliminated because the retail brokers affiliated with the WI market makers immediately debit the WI purchase amount from their clients' cash accounts.

[11] As part of the Neuer Markt listing requirements, IPOs designate sponsors who commit to making a liquid market in the firm's shares and posting spreads no larger than 4% at all times; Gerke and Bosch (2000) find an effective average bid-ask spread of 1.6% for secondary market transactions in Neuer Markt stocks during 1998.

[12] Shiller (1988) also notes that the majority of the survey respondents professed not to have conducted any fundamental research on the IPOs they bought.

https://doi.org/10.1017/S0022109009090024 Published online by Cambridge University Press

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Similarly, individual investors might be more willing to invest in an IPO if it is evident from the offering prospectus that the firm has already received backing from financial investors such as venture capitalists.

The impresario hypothesis formulated by Shiller (1988) states that the underwriter deliberately underprices the IPO like an impresario who "[. . .] may sometimes underprice tickets to concerts, so as to enhance the reputation of the performer (by creating a jam-packed auditorium and long lines for tickets) and thereby increasing the prices they can charge for subsequent concerts." Hoberg (2007) offers an alternative explanation for why some underwriters have a record of highly underpriced IPOs; firms whose valuation is subject to great information asymmetries—which drive the underpricing—tend to be brought public by the same highly-skilled underwriters.

To examine the possibility that retail investors condition their trading decisions on the underpricing history of an underwriter, I compute the equally-weighted average first-day returns of IPOs managed or comanaged by the underwriter from the beginning of 1997 up until the IPO in question; if an underwriter has not participated as a lead underwriter, I use the equally-weighted average first-day returns of all IPOs up until the IPO in question.

To test the conjecture that retail investors buy the IPOs that have caught their attention (e.g., Barber and Odean (2008)), I count the number of times a new issue is mentioned in newspaper articles both before and during the book-building period.[13] Presumably, IPOs with a greater presence in the news media will attract greater attention from investors for whom it is costly to gather fundamental information about IPOs.

Another conjecture concerns the relation between retail interest in an IPO and the market conditions at the time of the IPO. Put simply, retail investors might merely snap up stocks in the Internet or high-tech industry (Cooper, Dimitrov, and Rau (2001)). A variant of this hypothesis is reminiscent of the positive feedback trading hypothesis (DeLong, Shleifer, Summers, and Waldmann (1990b), Daniel, Hirshleifer, and Subrahmanyam (1998), and Rajan and Servaes (1997)); following a period of high market returns or high returns in similar stocks—such as stocks in the same industry as the IPO—retail investors are willing to place bolder bets, either because their portfolios have done well, giving them "house money" to play with (Thaler and Johnson (1990)), or because they form extrapolative expectations, or both.

Table 5 reports estimates for OLS regressions of two measures of retail IPO participation in the sample—the logarithm of gross WI purchases (see Column (1)) and the logarithm of gross day 1 purchases (see Column (2))—on IPO firm and offer characteristics as well as market conditions at the time of the IPO. Note that all regressors are calculated based on information publicly available before

[13]The news source is Factiva; it offers full-text coverage of three widely read national newspapers published in Munich, Frankfurt, and Berlin, as well as the public announcement paper of German stock exchanges: the *Süddeutsche Zeitung*, the *Frankfurter Allgemeine Zeitung*, the *Tageszeitung*, and the *Börsen-Zeitung*. All four newspapers are longstanding daily publications; their circulation changes little throughout the sample period.

the observed trading occurs (i.e., before the start of bookbuilding for WI purchases and before the IPO date for day 1 purchases).

TABLE 5

Determinants of Retail IPO Participation

Table 5 reports estimates for OLS regressions of two measures of retail IPO participation—the logarithm of gross WI purchases (Column (1)) and the logarithm of gross day 1 purchases (Column (2))—on IPO firm and offer characteristics as well as market conditions at the time of the IPO. The sample of firms consists of the 91 IPOs that go public between August 1, 1999 and May 31, 2000 and can be traded in the WI market by the sample investors. Unless otherwise noted, the firm and offer characteristics are defined as in Table 1. "Underwriter reputation" is the lead underwriter's market share based on the number of IPOs underwritten as lead before the beginning of the sample period (i.e., July 31, 1999). If two underwriters merge, the merged firm inherits the deals of both merging firms. The "Impresario index" score of the lead underwriter is its equally-weighted average underpricing as a lead underwriter from the beginning of 1997 up until the IPO. "Past industry return" is the one-month lagged return of an equally-weighted portfolio of stocks in the same industry as the IPO. The "Number of media mentions" is the number of times the IPO is mentioned in the three large national daily newspapers and a national financial daily before the IPO. The "Domestic firm dummy" is one if the firm is headquartered in Germany and zero otherwise. All columns report heteroskedasticity-robust standard errors, allowing errors to be arbitrarily correlated for same-week observations (Williams (2000)). ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

Dependent Variable	(1) Logarithm of Gross WI Purchases	(2) Logarithm of Gross Day 1 Purchases
Intercept	1.268	−3.364
	(2.081)	(5.718)
ln(Firm size)	0.461***	0.302
	(0.109)	(0.249)
MTB ratio	0.013	0.106**
	(0.020)	(0.042)
Underwriter reputation	−4.164	−2.364
	(3.756)	(4.744)
Venture capital backing	0.046	−0.008
	(0.045)	(0.075)
Impresario index	0.397	1.671
	(0.438)	(1.033)
Past industry return	2.660***	1.893
	(0.756)	(1.402)
Internet dummy	−0.245	0.479
	(0.390)	(0.469)
High-tech dummy	−0.093	0.581
	(0.233)	(0.464)
ln(Number of media mentions)	0.386*	−0.125
	(0.191)	(0.343)
Domestic firm dummy	0.366	0.332
	(0.260)	(0.500)
ln(Gross WI purchases)		0.698***
		(0.192)
Ancillary Statistics		
Number of observations	91	91
R^2	30.2%	33.4%

Other things being equal, firm size, lagged returns of stocks in the same industry, and media coverage of IPOs are strongly positively correlated with purchases in the WI market (see Column (1) of Table 5). These results are consistent with purchases being driven by attention or extrapolative expectations.[14] By contrast, there is little support for the certification and impresario hypotheses—other things being equal, neither the underwriter's market share nor its impresario index

[14]It should be noted that the interpretation of the positive correlation between media coverage and retail buying is complicated by the possibility that journalists are good at guessing what retail investors want to buy (and thus read about).

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score is significantly correlated with retail interest in the WI market. Note that, although the univariate correlation between retail WI purchase volume and the Internet dummy is positive, retail investors do not seem to disproportionately favor Internet or high-tech firms when controlling for other firm and offer characteristics.

Retail purchases on the IPO day are driven by similar factors as retail WI purchases. Column (2) of Table 5 shows that a 1% increase in retail WI purchases is associated with a 0.7% increase in retail purchases in the aftermarket. With the exception of the MTB ratio—day 1 investors appear to prefer glamour stocks—none of the other regressors helps explain variation in day 1 purchases once WI purchases are controlled for.

In principle, these regression results admit two behavioral interpretations. One, retail traders in the WI market are simply inexperienced investors for whom it is costly to gather publicly available information about the WI market such as WI quotes or the identity of the other side of the trade. Two, WI participants could be investors who, perhaps emboldened by past success, choose to bet against institutional investors.

Personal attributes and portfolio characteristics of those who trade in the WI market and those who trade on the day of the IPO lend support to the latter interpretation. The fraction of retail IPO investors who are male is even higher than the fraction of male discount brokerage clients. Moreover, retail IPO investors have more investing experience, are more likely to have traded online before the sample period, hold typically larger portfolios of stocks and mutual funds, have enjoyed higher returns before the sample period, and have traded much more aggressively before the sample period than their peers who do not invest in IPOs in the WI market or on the IPO day. These differences in characteristics point to confidence fueled by past returns, rather than inexperience or inattention, as a motive for trading IPOs (Barber and Odean (2002)).

V. Does Retail Sentiment Affect Aftermarket Prices?

The consistently poor performance of retail buyers in the WI market is remarkable in its own right. In addition to concerns about welfare, however, the interest in individual investor behavior centers on their potential impact on market outcomes such as prices.

A. Hypotheses

The combination of two crucial assumptions, overoptimistic investors and short-sale constraints, generates abnormally low aftermarket returns in the models of Derrien (2005), Ljungqvist et al. (2006), and Cornelli et al. (2006)—aggressive purchases by sentiment investors drive both the IPO offer price and the aftermarket price above the stock's fundamental value, and the stock underperforms in the aftermarket as the price reverts back to fundamental value (Purnanandam and Swaminathan (2004)).

A second, perhaps less straightforward, prediction of the models by Derrien (2005) and Ljungqvist et al. (2006) is that the degree of underpricing increases

https://doi.org/10.1017/S0022109009090024 Published online by Cambridge University Press

in investor sentiment. Ljungqvist et al. (2006) assume that current sentiment investors cannot fully absorb the issue and that there is a chance that investor sentiment will wane after the IPO. Underpricing then emerges as a compensation for rational investors to "store" overvalued shares until they can be sold to a new wave of sentiment investors. In Derrien (2005), underpricing emerges because the underwriter's costs associated with placing overvalued shares outweigh the benefits in form of higher fees.

The German IPO market offers an ideal setting in which to examine these theoretical predictions. Gross retail purchases of IPOs in the WI market or on the IPO day or both can serve as proxies for retail sentiment. Unlike allocations of shares following book-building, which are at the discretion of the lead underwriter, the trades in the WI market or the aftermarket are at the discretion of retail investors. Unlike investors who apply for shares during book-building, WI and day 1 buyers in German IPOs cannot rationally expect to get shares at the offer price and thus benefit from a highly underpriced IPO. Therefore, discretionary retail purchases in the WI market and in the aftermarket are a cleaner measure of retail sentiment than retail demand in the primary market. I use gross purchases rather than net purchases to capture the willingness to buy an IPO in the first place regardless of whether an investor decides later on, perhaps in response to intraday returns, to sell previously purchased shares. Moreover, since day 1 purchases appear to be motivated by similar factors as WI purchases, and since the sample WI purchases are a noisy measure of aggregate retail sentiment, I also consider the sum of WI and day 1 purchases; presumably, this aggregate measure is a more precise proxy for investor sentiment.[15]

B. Retail Sentiment and Underpricing

Both proxies for retail sentiment, the logarithm of gross WI purchases and the log of gross day 1 purchases, are strongly positively correlated with underpricing. The univariate correlations across the 91 sample IPOs are 0.40 and 0.43. Since it is possible that day 1 buyers make their trades conditional on the observed underpricing, I focus on the relation between WI purchases and underpricing.

Clearly, there are factors other than sentiment that affect underpricing, which raises concerns about omitted variables bias—WI purchases and underpricing might be positively correlated because they are both related to a third variable. For example, retail investors may flock to Internet and high-tech IPOs because of the recent performance of these sectors and the associated media coverage. At the same time, the difficulty of valuing such IPOs and the importance of information revelation by institutional investors may result in higher underpricing.

Aussenegg et al. (2006) make a more subtle point. They argue that WI prices might reflect information revealed by institutional investors to the underwriter

[15]Note that, although Schnigge, the leading WI market maker, makes aggregate WI trading volume publicly available from June 2000 onward, such volume is unlikely to be a good proxy for sentiment. First, although most WI purchases are made by retail investors, retail WI purchases as a fraction of all WI purchases may vary systematically across IPOs. Second, retail brokers restrict the participation of own accounts in the WI trading of IPOs that they underwrite themselves. Thus, aggregate retail WI participation also depends on the size and structure of the syndicate, which is difficult to capture.

https://doi.org/10.1017/S0022109009090024 Published online by Cambridge University Press

before the start of book building. Such information is used to set a binding offer price range at the start of book building; in exchange for the information, underwriters only partially adjust offer prices. In other words, there is a partial adjustment phenomenon in German IPOs, but, contrary to the U.S., it happens before the start of book building and is necessary to set binding offer prices ranges (Jenkinson et al. (2006) elaborate on this). To the extent this information leaks out and becomes public, retail investors in the WI market might become aware of and trade on it, though it is not necessarily profitable to do so—it is the informed investors who are rewarded with underpriced share allocations. As a result, one might observe that retail purchases are positively correlated with underpricing.

Guided by these concerns, I estimate a regression of underpricing on log firm size, MTB ratio, industry dummies for Internet and high-tech IPOs, the one-month lagged return of an equally-weighted portfolio of stocks in the same industry as the IPO, the proxy for IPO media coverage, and log WI purchases. In particular, I evaluate firm size, MTB ratio, and WI purchases at the midpoint of the offer price range, as opposed to at WI prices, to avoid documenting a spurious positive correlation between these variables and underpricing. The media variable is included as a regressor to capture any information leakage that may spuriously link retail trades and underpricing.

Table 6 reports the results of this regression. The relation between log WI purchases and underpricing is statistically and economically significant; other things being equal, a one-standard deviation increase in log WI purchases from its mean is associated with an increase in underpricing from 50% to almost 70%.

TABLE 6

Underpricing and Proxies for Retail Sentiment

Table 6 reports estimates for an OLS regression of underpricing, defined as the ratio of first aftermarket price to offer price, on IPO deal and market characteristics for the 91 firms that go public between August 1, 1999 and May 31, 2000, and that can be traded in the WI market by the sample investors. Unless otherwise noted, the firm and offer characteristics are defined as in Table 1. "Modified gross WI purchases" are aggregate WI purchases observed in the sample, evaluated at the midpoint of the offer price range instead of at actual WI prices. All columns report heteroskedasticity-robust standard errors, allowing errors to be arbitrarily correlated for same-week observations (Williams (2000)). ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

Dependent Variable	Underpricing
Intercept	2.720
	(1.843)
ln(Firm size)	−0.216**
	(0.082)
MTB ratio	0.033***
	(0.010)
Past industry return	2.354***
	(0.702)
Internet dummy	0.222
	(0.192)
High-tech dummy	−0.068
	(0.150)
ln(Number of media mentions)	0.085
	(0.117)
ln(Modified gross WI purchases)	0.142**
	(0.063)
Ancillary Statistics	
Number of observations	91
R^2	25.9%

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Consistent with Purnanandam and Swaminathan (2004), IPOs with higher MTB ratios exhibit higher underpricing and so do firms that go public following a period of high returns in similar stocks. These results are robust to including other variables that have been linked to underpricing such as firm age, insider sales, and underwriter reputation (not reported).

C. Retail Sentiment and Aftermarket Returns

The positive relation between WI purchases and underpricing is suggestive of retail sentiment affecting aftermarket IPO prices. It is possible, however, that both sentiment and prices are driven by, e.g., information privately revealed to the underwriter before book building that becomes public during book building. An analysis of the relation between retail IPO purchases and aftermarket returns offers a cleaner test of whether sentiment affects prices. If retail sentiment coupled with short-sale constraints drove prices above fundamental value, one would expect prices to revert back to fundamental value as short-sale constraints are relaxed or as sentiment investors reassess their overly optimistic beliefs about the stock (e.g., after disappointing earnings news). If, however, retail purchases were accommodated by sellers without affecting prices, one would not expect a systematic relation between retail IPO purchases and aftermarket returns.

Specifically, I compute six-month aftermarket returns starting at the one-month anniversary of the IPO to avoid any distortions from underwriter stabilization efforts. I choose a six-month period to capture price effects due to lock-up expirations. Such expirations typically occur six months after the IPO (Nowak and Gropp (2002)) and can be interpreted as a relaxation of short-sale constraints (Ofek and Richardson (2003) or Field and Hanka (2001)); presumably, insiders who think their equity overvalued at lock-up expiration will sell more aggressively, other things being equal.

The sample of IPOs is quite heterogenous in terms of characteristics that have been linked to cross-sectional variation in returns (e.g., size, MTB, and industry). To examine the robustness of the results, I consider different aftermarket returns: raw returns, returns in excess of the Dax 100, the Nemax 50, an equally-weighted portfolio of German stocks with the same Datastream industry designation as the IPO, and an equally-weighted portfolio of German stocks with similar size and MTB characteristics as the IPO.[16]

Retail participation in the WI market and aftermarket returns are indeed negatively correlated. The cross-sectional correlation between the logarithm of the value of observed gross WI purchases and the six-month aftermarket return is -0.3.

To further assess whether aggressive retail IPO purchases are followed by poor aftermarket returns, I estimate regressions of aftermarket excess returns on retail purchases of IPOs both in the WI market and in the aftermarket—controlling for the firm's market capitalization, MTB ratio, and industry.

[16]Specifically, I sort all German stocks in Datastream at the end of month $t-1$ into three size bins according to their market capitalization. Within each size bin, I sort stocks into three MTB bins, which yields nine size/MTB bins containing the same number of firms. A firm going public in month t is assigned to one of the nine bins based on its market capitalization and MTB ratio evaluated at the midpoint of the filing range.

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Table 7 reports the results of the multi-variate regressions. Columns (1)–(4) of Table 7 show that, other things being equal, the logarithm of WI purchases is negatively correlated with aftermarket returns in excess of the Dax 100, Nemax 50, an industry benchmark portfolio, and a characteristics-matched portfolio. The correlations are significant both in statistical and economic terms. For example, a one-standard deviation increase in the log of WI purchases is associated with a 17% lower six-month return in excess of the Nemax 50 starting at the one-month anniversary of the IPO (i.e., −4% instead of the average 13%); the results are even stronger for the other return benchmarks. Although Internet firms perform especially poorly in the aftermarket, the negative relation between retail IPO purchases and aftermarket returns is not merely an industry effect. Note that other firm characteristics that have been linked to aftermarket returns, such as underwriter reputation, gearing, or turnover (Eckbo and Norli (2005)), fail to explain additional variation in aftermarket returns (not reported).

TABLE 7

OLS Regressions of Aftermarket Returns on Proxies for Retail Sentiment

The sample of firms consists of the 91 IPOs that go public between August 1, 1999 and May 31, 2000, and that can be traded in the WI market by the sample investors. Raw returns and excess returns are measured from the close of the one-month anniversary of the IPO to the close of the trading day 26 weeks from that date. The Dax 100 is the index of the 100 largest and most liquid German stocks. The Nemax 50 is the index of the 50 largest and most liquid stocks listing on the Neuer Market. The industry portfolio return is the equally-weighted return of all German stocks with the same Datastream industry designation as the IPO. The size- and market-to-book (MTB) matched portfolio return is the equally-weighted return of all German stocks in the same size and MTB ratio bin as the IPO at the end of the month prior to the IPO. Regressors include the logarithm of the firm's market capitalization, its MTB ratio, high-tech and Internet industry dummies, and one of two measures of retail sentiment: "WI Purchases" (the aggregate DEM value of all WI purchases in the IPO) and "WI + Day 1 Purchases" (the aggregate DEM value of all WI and day 1 purchases). The firm characteristics are defined as in Table 1. All columns report heteroskedasticity-robust standard errors that allow same-week observations to be arbitrarily correlated (Williams (2000)). ***, **, and * indicate that the coefficient estimates are significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Excess Returns over Benchmark Portfolio							
Dependent Variable	Dax 100 (1)	Nemax 50 (2)	Industry (3)	Size, MTB (4)	Dax 100 (5)	Nemax 50 (6)	Industry (7)	Size, MTB (8)
Intercept	3.602	−0.083	1.791	4.156*	4.163*	0.811	2.141	4.689**
	(2.275)	(1.767)	(2.020)	(2.200)	(2.119)	(1.792)	(1.968)	(2.030)
ln(Firm size)	−0.044	0.099	0.021	−0.053	0.010	0.101	0.054	−0.003
	(0.113)	(0.092)	(0.105)	(0.106)	(0.114)	(0.095)	(0.103)	(0.106)
MTB ratio	0.037	0.008	0.030	0.037	0.045	0.018	0.036*	0.046
	(0.032)	(0.020)	(0.020)	(0.030)	(0.029)	(0.020)	(0.019)	(0.028)
Internet dummy	−0.691***	−0.377**	−0.554***	−0.747***	−0.631***	−0.398**	−0.511***	−0.682***
	(0.204)	(0.173)	(0.176)	(0.204)	(0.167)	(0.161)	(0.155)	(0.166)
High-tech dummy	−0.194	0.069	−0.136	−0.254	−0.103	0.079	−0.071	−0.155
	(0.234)	(0.210)	(0.214)	(0.233)	(0.219)	(0.208)	(0.208)	(0.219)
ln(WI purchases)	−0.210*	−0.148*	−0.161*	−0.241**				
	(0.116)	(0.087)	(0.085)	(0.114)				
ln(WI + day 1 purchases)					−0.323***	−0.202**	−0.229**	−0.344***
					(0.098)	(0.091)	(0.086)	(0.096)
Ancillary Statistics								
Number of observations				All 91 sample IPOs				
R^2	15.1%	8.6%	11.2%	18.1%	22.9%	12.9%	15.7%	26.0%

The observed WI purchases are a noisy measure of market-wide retail sentiment. The sum of purchases in the WI market and the immediate aftermarket may be more representative of the aggregate actions of sentiment investors. Indeed, Columns (5)–(8) of Table 7 show that, other things being equal, the negative correlation between the more comprehensive sentiment measure and aftermarket

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excess returns is stronger. For example, a one-standard deviation increase in the log of WI plus day 1 purchases is associated with a 23% lower six-month return in excess of the Nemax 50 starting at the one-month anniversary of the IPO; again, the results are stronger for the other benchmarks.

The results are similar but tend to be a bit weaker, when I compute aftermarket returns from the day of the IPO instead of its one-month anniversary (not reported). One explanation is that underwriters provide price stabilization in IPOs with weak aftermarket demand, which partially offsets the relation between prices and retail IPO purchases.

To check whether the return reversals tend to be concentrated in a particular subperiod, I split my sample of 91 IPOs in two halves by the number of IPOs. As a result, the first subperiod captures mostly an upmarket and the second subperiod mostly a downmarket. Retail IPO purchases are negatively related to aftermarket returns in both subsamples; there is no systematic pattern across the two subperiods (not reported).

Cornelli et al. (2006) argue that the relation between WI prices and the offer price range can proxy for retail optimism or pessimism; given short-sale constraints, WI prices will reflect retail optimism (which drives prices above fundamental value initially but is subsequently associated with lower returns), but not retail pessimism. I construct a regressor similar to theirs: a variable that takes on the value of the ratio of the average WI purchase price to the midpoint of the IPO filing range if the average WI price is above the midpoint of the filing range and zero otherwise.[17] This variable fails to explain additional variation in aftermarket returns (not reported). Since I use a different sample, and the data to replicate their study are not publicly available, it is difficult to pinpoint exactly what drives the differences.

Taken together, the positive association between discretionary retail IPO purchases and underpricing and the negative association between retail IPO purchases and aftermarket returns in the sample are consistent with retail sentiment causing prices to deviate from fundamental value—either because sentiment investors move prices themselves or because other investors successfully predict sentiment (Brunnermeier and Nagel (2004)).

VI. Conclusion

Sentiment drives IPO purchases made by a sample of clients at a German retail broker. This can be inferred from the clients' willingness to trade against institutional investors in the WI market and pay a substantial WI premium relative to prices in the immediate aftermarket. The inference that investors act on sentiment is therefore not based on long-horizon returns as in prior work.

[17]Note that Cornelli et al. (2006) test the explanatory power of their sentiment measure, the ratio of the last WI price before the setting of the offer price to the midpoint of the IPO filing range, in two separate regressions—one for the case where the last WI price is above the midpoint filing range and one for the case where the last WI price is equal to or less than the midpoint of the filing range. I choose a different regression setup, as the average WI purchase price is above the filing range in almost all of my sample IPOs.

https://doi.org/10.1017/S0022109009090024 Published online by Cambridge University Press

Although the period during which I observe individual-level WI transaction data only spans August 1999 to May 2000, the poor performance of retail investors in the WI market can be confirmed out of sample, using publicly available WI data provided by a leading WI market maker for the subsequent period from June 2000 to April 2001. Specifically, I document that retail investors remain willing to pay the WI premium even after the crash of mid-2000. This suggests that sentiment investors do not simply disappear during periods of poor returns.

The poor performance of IPOs aggressively bought by retail investors, either in the WI market or in the aftermarket or both, is consistent with retail sentiment initially pushing aftermarket prices above fundamental values. In particular, variation in retail IPO purchases explains variation in aftermarket returns during my sample period, after controlling for IPO characteristics that have been previously related to aftermarket returns.

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