Contrarian and Momentum Strategies in Germany

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Two traditional methods of managing equity portfolios are investing based on price momentum and value-based contrarian investing. These strategies may be motivated by a behavioral theory of under- and overreaction to news or by empirical research, mostly for the NYSE, that has found persistence in price movements over short horizons and reversion to the mean over longer horizons. However, the apparent success of these strategies may be due to institutional factors and the mismeasurement of risk, or it may result from data mining. For these reasons, we studied all major German companies listed on the Frankfurt Stock Exchange for the three decades between 1961 and 1991. The dynamics of stock prices in Frankfurt are remarkably similar to New York. The data suggest that equity prices reflect investor forecasts of company profits that are predictably wrong.

Several studies of asset pricing, mostly based on U.S. data, have found predictability in equity returns—in particular, short-term price momentum and long-term price reversals. These stylized facts are the empirical basis for investment strategies that earn unusual profits relative to standard valuation models, such as the capital asset pricing model (CAPM).

Contrarian strategies buy stocks that performed poorly over the past two to five years (prior losers) and sell short stocks that performed well over the same period (prior winners). This approach earns subsequent excess returns of about 8 percent per year (De Bondt and Thaler 1985). Even though the findings are more than a decade old, the sources of the apparent profits remain a matter of continuing and sometimes vehement debate. Many explanations, not mutually exclusive, are possible. First, the profits may be partly illusory, a product of methodological and measurement problems (Ball, Kothari, and Shanken 1995). It may also be that the excess returns are "real" but rational compensation for time-varying risk (Chan 1988; Fama 1991) or that they reflect well-known seasonal and size effects in returns. Finally, there may be truth to the psychological arguments, based on investor overreaction, that originally motivated the research (Dreman 1982; De Bondt and Thaler 1985).

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In contrast, Jegadeesh and Titman (1993) and others have documented the seeming profitability of momentum strategies. Over short periods of 3–12 months, there is a considerable degree of stock return persistence.[1] Momentum (or "relative strength") strategies entail the purchase of stocks that performed well in the past and the sale of stocks that performed poorly—the exact opposite of what contrarians recommend. The related observations—(1) that price momentum strategies seem profitable and (2) that the volume of profits is linked to the "slow" adjustment of prices to earnings surprises as well as to (3) the "slow" revision of analyst earnings forecasts—all point to the conclusion that the market underreacts to information, especially news about company income (Chan, Jegadeesh, and Lakonishok 1996).

This article reexamines the profitability of short- and long-term trading strategies with data from the Frankfurt Stock Exchange (FSE). We used complete price data for 31 years: 1961–1991. Our research was motivated by three facts. First, the institutional setting and trading practices in Frankfurt are quite different from New York. For example, there are no specialists and for many stocks there is no continuous trading. Also, there are no explicit bid–ask spreads.[2] Next, it is always of interest to cross-check in a second market the empirical results first established somewhere else. Individually and/or collectively, finance researchers are often charged with data mining. Of course, new data is the best answer to this indictment.[3] A final rationale for our study is that German financial markets are of interest in their own right. Many German companies, such as Daimler-Benz, BASF,

or Siemens, are export oriented and enjoy a world-wide reputation. It may well be said that many of these firms, which trade in Frankfurt, represent the industrial engine of continental Europe.

As it happens, our analysis shows that stock price dynamics in Germany are remarkably similar to what is seen in the United States. Momentum and contrarian strategies both appear to be profitable.

The article reviews some institutional aspects of the FSE, describes the investment strategies that we studied, presents the main results, and offers various robustness tests.

The Frankfurt Stock Exchange

Frankfurt has been a merchant city and financial center since the Middle Ages.[4] The first exchange office was opened in the year 1402. Transactions were mainly in currencies and bills of exchange. The Frankfurt Exchange was founded in early September 1585, with a resolution of the city council to guarantee the exchange rates for nine different currencies. Shares started trading in 1820. Today, shares, bonds, currencies, and derivatives are traded. Since 1991, Deutsche Boerse AG, a joint stock company owned by banks and brokers, is responsible for the operation of the exchange.[5] It finances itself largely with user fees—for example, for order routing systems—and licensing agreements that cover the use of, for example, the DAX share index. The FSE is a separate legal entity, organized under public law. Its board supervises trading, enforces regulations, and admits new securities to the market. Recently, strict insider-trading laws and disclosure requirements have been developed by the German federal government (*das Wertpapierhandelgesetz*). Annual share turnover has grown from about DM5 billion during the early 1960s to DM12 billion in 1970, DM28 billion in 1980, and DM1.62 trillion in 1990 (Deutsches Aktieninstitut, 1997).

The exchange has three groups of members: banks, *kursmaklers*, and free *maklers*. *Kursmaklers* and free *maklers* are brokers that intermediate between banks. (They do not represent private investors.) *Kursmaklers* determine share prices. In 1993, there were 135 bank members of the FSE (including 66 foreign banks), 40 *kursmaklers*, and 57 free *maklers*.

Investors can only trade securities through a bank represented on the FSE. They can issue market orders, limit orders, and stop orders (for heavily traded shares). Except for continuously traded securities, trading occurs at a single price defined daily on the basis of the *kursmakler*'s order book. At noon, the *kursmakler* tallies all the market and limit orders and sets a price that equalizes supply with demand. All sell orders with a higher limit and all buy orders with a lower limit remain unexecuted. The *kursmakler* may balance supply and demand as a principal, on personal account, if he names an "ultimate" buyer or seller by the end of the next trading session. The volume in name-to-follow trades is strictly regulated. It only facilitates order execution.

For continuously traded shares, the same single-price method is used repeatedly. The opening price is set at 10:30 a.m. In general, there is no priority according to the amount of the order or the time it is received. If the new price is likely to differ more than 5 percent from the last quoted price, then the *kursmakler* is obliged to publicly announce an estimate of the new price. After a delay, the new price is set in agreement with supervising officers appointed by the FSE. Trading ends at 1:30 p.m.

Investors pay *kursmakler* and bank commissions but, since the end of 1990, no turnover tax. *Kursmakler* commissions are currently equal to 0.06 percent of the share price. For institutional investors, total trading costs are around 0.5 percent.[6]

Methods and Tests

Our study used return and accounting data for a total of 357 companies listed in the top segment of the FSE (*der amtliche Handel*) between January 1961 and December 1991. All firms were headquartered in Germany; that is, we excluded foreign companies listed in Frankfurt. The return data were provided by the Deutsche Finanzmarktdatenbank at the University of Karlsruhe. Between 1961 and 1991, the DAX share index roughly tripled and the combined market value of the shares listed in Frankfurt was multiplied by more than five.[7] The S&P 500 Index and the DAX showed a mild tendency to move together. The volatility of the U.S. and German markets was comparable. Judging from movements in industrial production and interest rates, the German economy was in recession in 1966, 1971, 1974, 1980–1982, and 1991. The average annual growth rate in industrial production was 2.9 percent (with a range between –5.6 percent and 11.3 percent); the average annual inflation rate was 3.5 percent (with a range between –1.0 percent and 7.9 percent).[8]

Trading volume rose throughout the period that we studied but skyrocketed during the late 1980s. This is partly due to the increased participation of non-Germans. For instance, in 1987, transactions with foreign investors amounted to 57 percent of all trading volume. The unification boom in 1989 and 1990 stimulated more international interest. At the end of 1996, total trading volume was DM2.3 trillion. Of all shares issued by German firms, 24 percent were controlled by foreigners. (In 1984, the fraction was 16 percent.) Also, 19 percent

of shares were owned by 3.8 million private residents of Germany, 24 percent were held by government agencies and institutional investors, and 33 percent represented cross-holdings between nonfinancial companies (Deutsches Aktieninstitut 1997).

Table 1 describes the cross-section of securities in our sample. We employed hand-collected data from annual reports and other sources. The main source was the *Saling Aktienfuehrer* (vol. 54–86, 1961–93) published by Verlag Hoppenstedt & Company in Darmstadt, Germany. In 1985, the market value of common shares for the average company in the sample was DM1.8 billion. (In 1965, it was DM416 million.) The average sales were DM3.8 billion. (In 1965, DM521 million.) The average P/E in 1985 was 29. The average ratio of debt to assets (with both statistics based on book values) was 61 percent. Since there are many more small than there are large firms, the means are usually much larger than the corresponding medians listed in Table 1.

The various companies belong to 11 different industries. Interestingly, the companies that dominated the landscape of German industry in 1965, by and large, still did so in 1985. However, two industries—(1) banking and insurance and (2) automobile—strongly gained in importance. As a fraction of the market value of all firms in our sample, their combined shares rose from 22 percent in 1965 to 51 percent in 1985. On the other hand, electrical, chemical, and pharmaceutical companies lost importance.

Many of the findings presented here compare security returns to market returns. For every firm j and month t, we found the excess return by subtracting the market index return $R_{m,t}$ from the total return $R_{j,t}$—that is, $AR_{j,t} = R_{j,t} - R_{m,t}$. We employed two market indexes: (1) an equally weighted index of returns for all stocks listed on the exchange and (2) a value-weighted index published by the *Frankfurter Allgemeine Zeitung*. To find excess returns for each stock over n months ($CAR_{j,n}$), two methods were employed. The first method simply cumu-

Table 1. A Sample of Equity Securities by Industry in 1965 and 1985

Industry	Assets (DM millions)	Sales (DM millions)	Earnings (DM millions)	Dividends (DM millions)	MV (DM millions)	D/A	P/E	Number of Observations
A. 1965								
Au	397.6	508.2	23.8	14.3	331.7	54	19.4	18
B	1,363.4	92.9	1.1	3.2	84.7	86	28.5	29
C	35.4	47.5	1.1	0.7	20.5	66	19.3	40
Ch	192.0	225.8	8.6	7.1	163.0	58	22.7	18
E	114.3	136.6	2.9	1.3	42.6	69	18.5	10
H	116.9	111.3	2.1	1.6	44.1	70	16.8	30
M	221.0	263.7	4.9	3.6	86.7	64	19.7	14
R	232.3	117.6	4.5	4.9	94.9	59	20.4	10
Re	100.4	201.7	7.6	4.2	113.2	65	16.7	15
St	1,201.3	1,073.9	20.8	20.8	445.5	67	14.7	11
U	149.7	85.0	11.0	6.8	174.0	31	18.1	22
All	141.3	136.6	4.4	3.5	91.1	64	20.1	217
B. 1985								
Au	1,440.0	1,101.4	33.6	26.4	893.2	65	16.5	13
B	10,524.2	1,428.6	26.4	13.1	960.0	82	34.1	31
C	201.0	327.6	4.3	3.0	123.2	62	24.4	35
Ch	566.0	992.9	12.2	19.8	450.2	63	22.6	20
E	536.0	737.6	25.7	12.7	436.8	70	27.2	13
H	347.8	458.7	6.9	7.3	213.3	71	20.4	36
M	970.0	1,201.3	8.0	37.9	933.7	56	29.6	8
R	875.9	1,869.2	225.0	21.2	603.2	63	37.9	12
Re	508.3	703.4	99.0	14.5	310.8	67	25.2	21
St	5,743.0	6,276.0	256.0	46.1	853.9	65	11.3	7
U	1,893.5	862.8	26.4	34.4	817.9	39	28.4	20
All	692.3	741.6	15.2	12.0	414.5	65	25.3	216

Note: Listed are median values of assets, annual sales, earnings, dividends, market value of common shares (MV), and ratio of book value of debt to assets, D/A (× 100). The median P/E within each industry is based on a subset of firms, namely, those for which we had complete accounting data (including assets, sales, and so on). Au = automobile, B = banking and insurance, C = consumer products, Ch = chemical, E = electrical, H = heavy machinery, M = metals and mining, R = retail and services, Re = construction and real estate, St = steel, and U = utilities.

lated $AR_{j,t}$ through time ($t = 1,\ldots, n$), where $n = 1$, 3, 6, 12, or 60. The second method was equivalent to a buy-and-hold return. It combined the returns for each stock multiplicatively, $[(1 + R_{j,1})(1 + R_{j,2})\ldots(1 + R_{j,n})]$, and subtracted the compounded market return, $[(1 + R_{m,1})(1 + R_{m,2})\ldots(1 + R_{m,n})]$. All the results presented in the tables are based on buy-and-hold (excess) returns.[9]

The cumulative excess returns—computed for an initial time period of n months (the "rank period")—were used to rank the firms. The top 10, 20, or 40 performers were assigned to the winner portfolio; the bottom 10, 20, or 40, to the loser portfolio. We also found average CAR_n for all firms in the winner and loser portfolios during the rank period. Finally, we found the winner and loser portfolio excess returns for the subsequent test period.[10]

In order to judge the performance of short-term momentum strategies, we systematically "bought" past winners and "sold" past losers short. Thus, by construction, the portfolios were zero-investment arbitrage portfolios. In each case, the length of the test period was set at 12 months. The rank periods were 1, 3, 6, or 12 months in length. We followed the calendar year; that is, the various rank periods terminated at the end of each year, each half-year (January–June and July–December), each quarter (January–March, April–June, July–September, October–December), or each month. This technique avoided overlapping rank periods and thereby guaranteed the independence of return observations. There were 360 winner and loser portfolio replications based on a 1-month rank period, 120 replications based on a 3-month rank period, 60 based on a 6-month rank period, and 30 based on a 12-month rank period. The number of shares included in the various replications remained quite stable over time; for example, in the 12-month case, it varied between 183 (for 1973) and 267 (for 1990). The average was 206 companies.

To judge the performance of long-term contrarian strategies, we again studied arbitrage portfolios. However, this time, we bought past losers and sold past winners short. At the end of each year between 1965 and 1986, winner and loser portfolios were formed based on a five-year rank period. For each of 22 replications, the test period extended through the subsequent five years. The total number of stocks included in the various replications hardly varied through time. The minimum was 169 (1972). The maximum was 201 (1965 and 1966). The number of delistings from the winner and loser portfolios was small and never exceeded four in a single replication.

Strategy Performance

We discuss the results of the momentum and contrarian strategies in turn. After a review of the results and additional robustness tests, we briefly explore the question of why the investment approach appears to succeed.

Momentum Investing. Table 2 and Table 3 summarize the main results. To repeat, the rank periods were either 1, 3, 6, or 12 months long. They were nonoverlapping. Therefore, we examined multiple independent replications of the momentum strategies. For instance, with a 1-month rank period, there were 360 replications. Table 2 lists cumulative buy-and-hold excess returns. (The flavor of the results did not change if we used additive excess returns.) Whenever we present separate results for winner and loser portfolios, the market return was measured by an equally weighted average return of all securities in the sample. Table 3 reports the percentage of times that, after 12 months, the winner, loser, and arbitrage (i.e., winners minus losers) portfolios ended up "in the black"—that is, with net positive performance. These counts are a robustness check that gives equal weight to every replication of the investment program.[11]

With a rank period of one month, portfolios of 20 prior winners outperformed prior losers, after 12 months, 62 percent of the time. Winners were about as likely to outperform the market (63 percent) as losers were likely to underperform the market (63 percent). The performance gap added up to a small but statistically significant 1.5 percent. Here, as well as later, past winners contributed slightly more to the profit of the arbitrage portfolio than did past losers.

If momentum strategies succeed because the market underreacts to news, then one would expect that the effect would have been stronger if past performance had been more extreme. The reason is simply that there was more news. In agreement with this point of view, portfolios of 2 times 10 stocks (rather than 2 times 20 stocks) earned, on average, a little more: 1.9 percent (not reported here). The cumulative performance of these stocks during the rank period (CAR_{rp}) was 30 percent. Portfolios of 2 times 40 stocks earned only 1.0 percent. (In this case, CAR_{rp} was 17 percent.)

Also in accord with underreaction, momentum strategies performed better if the rank period was longer. Over a rank period of three months, the average past winner in a portfolio of 20 stocks gained 21 percent and the average loser gave up 20 percent. During the test period, the winner portfolio yielded abnormal performance, after 12 months, of 3.5 percent. The loser portfolio lost 2.1 percent.

Table 2. Momentum Strategies: Cumulative Excess Returns, 1961–91 and Subperiods
(*t*-statistics in parentheses)

Strategy	CAR_{rp}	CAR_3	CAR_6	CAR_9	CAR_{12}
A. One-month rank period					
20 W 1961–90	13.18%	0.00%	0.35%	0.02%	0.78%
		(0.02)	(2.38)	(0.17)	(5.64)
20 L 1961–90	–10.43	–0.20	–0.15	–0.25	–0.70
		(–1.24)	(–1.03)	(–1.70)	(–4.65)
20 W – L 1961–90	23.61	0.20	0.50	0.28	1.49
		(0.78)	(2.14)	(1.24)	(6.35)
20 W – L 1961–70	22.06	–0.62	0.73	0.22	0.96
20 W – L 1971–80	21.37	0.82	0.74	0.38	1.33
20 W – L 1981–90	27.41	0.41	0.04	0.24	2.17
B. Three-month rank period					
20 W 1961–90	20.76	0.31	1.46	2.10	3.47
		(0.99)	(3.10)	(3.32)	(4.78)
20 L 1961–90	–19.58	0.38	–0.07	–0.80	–2.06
		(1.06)	(–0.18)	(–1.40)	(–3.05)
20 W – L 1961–90	40.35	–0.07	1.53	2.90	5.52
		(–0.15)	(2.45)	(3.40)	(5.57)
20 W – L Quarter 1 1961–90	44.15	0.67	1.36	3.29	5.99
20 W – L Quarter 2 1961–90	40.78	0.52	1.05	2.29	5.05
20 W – L Quarter 3 1961–90	38.95	0.51	3.56	4.36	6.82
20 W – L Quarter 4 1961–90	38.57	–1.98	0.16	1.64	4.24
20 W – L 1961–70	39.01	–1.35	0.02	1.46	3.59
20 W – L 1971–80	36.32	0.13	1.17	1.42	2.17
20 W – L 1981–90	46.73	1.00	3.40	5.81	10.81
20 W – L 1965–89	na	–0.03	1.56	2.61	5.40
Jegadeesh–Titman	na	0.96	1.74	5.40	8.28
C. Six-month rank period					
20 W 1961–90	30.07	0.28	1.95	3.12	4.15
		(0.46)	2.24	2.95	(3.66)
20 L 1961–90	–29.44	0.37	–1.51	–2.73	–3.92
		(0.67)	(–2.09)	(–2.78)	(–3.34)
20 W – L 1961–90	59.51	–0.09	3.46	5.84	8.07
		(–0.11)	(3.06)	(4.06)	(4.95)
20 W – L First half 1961–90	61.33	1.25	5.20	8.20	10.18
20 W – L Second half 1961–90	57.69	–1.44	1.71	3.49	5.97
20 W – L 1961–70	55.90	–0.39	0.05	0.74	2.26
20 W – L 1971–80	53.38	0.88	4.99	8.31	8.83
20 W – L 1981–90	69.31	–0.77	5.33	8.48	13.13
20 W – L 1965–89	na	0.09	4.32	6.75	8.76
Jegadeesh–Titman	na	2.52	5.70	9.18	10.32
D. Twelve-month rank period					
20 W 1961–90	47.05	1.77	3.06	3.06	4.14
		(1.88)	(3.27)	(2.33)	(2.59)
20 L 1961–90	–45.90	0.98	–1.84	–0.83	–1.07
		(0.83)	(–1.57)	(–0.52)	(–0.47)
20 W – L 1961–90	92.95	0.80	4.90	3.89	5.21
		(0.53)	(3.26)	(1.88)	(1.87)
20 W – L 1961–70	81.12	–2.01	0.96	0.27	1.06
20 W – L 1971–80	83.71	4.83	8.85	8.55	5.31
20 W – L 1981–90	114.04	–0.43	4.90	2.85	9.24
20 W – L 1965–89	na	1.11	5.40	4.95	5.52
Jegadeesh–Titman	na	3.93	6.84	8.37	8.16

na = not applicable.

Note: Shown is the performance of winners (W), losers (L), and momentum portfolios (W – L) during the rank period (CAR_{rp}) and test periods ($CAR_3, \ldots, CAR_{12}$). The last test period was 1991. The extreme portfolios contained 20 stocks.

Table 3. Robustness Tests for Momentum Strategies

Strategy	Winners		Losers		Arbitrage Portfolio (W - L)	
	# Pos.[a]	# Neg.[b]	# Pos.[a]	# Neg.[b]	# Pos.[a]	# Neg.[b]
A. One-month rank period (360 replications)						
Rank each month						
Total	225	135	132	228	223	137
Percent	63	37	37	63	62	38
B. Three-month rank period (120 replications)						
Rank each quarter						
Total	78	42	42	78	80	40
Percent	65	35	35	65	67	33
C. Six-month rank period (60 replications)						
Rank each half-year						
Total	42	18	16	44	46	14
Percent	70	30	27	73	77	23
D. Twelve-month rank period (30 replications)						
Rank each year						
Total	11	19	20	10	17	13
Percent	37	63	67	33	57	43

[a]Number of times the 12-month test-period cumulative excess return was positive.
[b]Number of times the 12-month test-period cumulative excess return was negative.

Note: All winner and loser strategies were for portfolios with 20 stocks; the arbitrage portfolio had 40 stocks.

The success rate of the arbitrage portfolio was 67 percent. It earned on average 5.5 percent. The arbitrage portfolios did even better with a rank period of six months. More than three-quarters of the time, the investment program offered a positive result. It earned 8.1 percent. The winners went up by an additional 4.2 percent. The losers went down by another 3.9 percent. If the arbitrage portfolio was composed of 2 times 40 stocks, its profit fell to 6.7 percent (CAR_{rp} was 45 percent). If the portfolio contained 20 stocks, its profit rose to 11.4 percent (CAR_{rp} was 76 percent).

The performance of the momentum strategy deteriorated if the rank period was further lengthened to 12 months. On average, a portfolio of 20 winner stocks realized an abnormal return of 4.1 percent over 12 months. A comparable portfolio of losers trailed the market by 1.1 percent. The strategy worked 57 percent of the time. As seen in Table 3, the problem is clear: The losers beat the market for 20 out of 30 replications, and the winners did so only 11 times. Yet, the arbitrage portfolio offered, on average, positive returns.

A point of some interest is that the profitability of momentum investing rose over time. For instance, with a 12-month rank period, the average CAR_{12} rose from 1.1 percent for the 1960s to 5.3 percent for the 1970s and to 9.2 percent for the 1980s. Even though this finding applies more generally, it defies easy interpretation.

Is the underreaction effect seasonal? The evidence (not reported in Tables 2 and 3) is mixed. There are certainly small differences in profits by month of the year, by quarter, and so on. For example, in a six-month momentum strategy, it "helped" to shift the various replications by a half-year so that July became the first test month rather than January. Performance rose from 6.0 percent to 10.2 percent. In the first instance, winners earned 3.0 percent and losers earned –3.0 percent. In the second, the split was 5.3 percent versus –4.9 percent. We are inclined not to overinterpret these nuances.

To allow a direct comparison with earlier findings for the United States (Jegadeesh and Titman), we also examined the 1965–89 period. The German results offer some interesting parallels. For instance, strategies with a 6-month rank period attained, on average, the best results after 12 months. Also, to maximize expected profit over a 6-month period, it is best to rank shares by their excess returns over the previous 12 months.

When should a momentum investor rebalance a portfolio? Although not reported in Tables 2 and 3, we studied momentum strategies with a rank period of 12 months and a test period of two to five years. We compared those strategies with a "rolling" portfolio that was updated annually. The rolling portfolio beat the momentum strategy in every instance.

Contrarian Investing. As shown in Table 4, the contrarian strategy that we investigated bought past losers and sold past winners for up to five years. Portfolios with 20 stocks obtained an average cumulative excess return of 21.7 percent during the test period.[12] The result was dictated by what happened to the loser portfolio, and it developed during the third, fourth, and fifth year. Statistically, the behavior of the winner portfolio was indistinguishable from market performance. Since we had only 22 replications with partially overlapping test periods, the *t*-statistics in Table 4 were corrected for serial correlation and heteroscedasticity as in Newey and West (1987). The arbitrage portfolio showed a positive result in 15 of 22 cases, but the corresponding *t*-statistic was marginal at best.

With winner and loser portfolios of 10 stocks only, the average profit rose to 26.8 percent. With portfolios of 40 stocks, it dropped to 16.7 percent. Both times, however, the results may be due to chance since they do not reach statistical significance. Contrarian investing was most successful during the second half of the 1961–91 period. The first 11 replications earned on average only 11.8 percent after a five-year test period. The remaining 11 replications achieved a return of 31.6 percent.

Ignoring past performance, how different were the winner and loser firms in the contrarian portfolios from the winners and losers in the momentum portfolios? How different were winners and losers from other companies? Although not reported in detail here, we attempted to answer these questions using various measures of firm size (assets, sales, market value), profitability (earnings, dividends), value (P/E), and corporate financing (debt-to-assets ratio). We were not able to detect any persistent dissimilarities. However, there was one exception. The P/Es of winners were almost always higher than the P/Es of losers or other firms. This was even true for one- and three-month momentum strategies.

Risk and Return. Apart from behavioral explanations of under- and overreaction (De Bondt 1995, 1999; Barberis, Shleifer, and Vishny 1998; Daniel, Hirshleifer, and Subrahmanyam 1998), there is a series of other possible reasons for the results. Many of the explanations have to do with "risk." For instance, past studies have found a relationship between stock returns, firm size, and the level of share prices.

For 12-month momentum portfolios, the average market value of equity was indeed somewhat smaller for losers (DM590 million) than for winner companies (DM930 million).[13] The winner and loser companies also differed in their business success. Relative to book value, the accounting earnings of losers were 6.9 percent during the rank period and 7.6 percent during the test period. For winners, the equivalent values were 16.3 percent and 15.4 percent.[14] Finally, the average price of losers (DM261) was significantly smaller than the average price for winners (DM423). The *t*-statistic for the difference in means was 3.1. The effect was present in 27 of 30 rank periods.[15]

Table 4. Contrarian Strategies: Cumulative Excess Returns, 1961–91 and Subperiods
(*t*-statistics in parentheses)

Strategy	CAR_{12}	CAR_{24}	CAR_{36}	CAR_{48}	CAR_{60}
20 W 1961–86	3.19%	4.30%	3.78%	–0.79%	0.67%
	(2.73)	(1.58)	(0.82)	(–0.13)	(0.09)
	[16/6]	[14/8]	[13/9]	[13/9]	[13/9]
20 L 1961–86	3.19	8.08	14.35	18.49	22.37
	(2.18)	(2.92)	(2.96)	(2.62)	(2.33)
	[12/10]	[14/8]	[15/7]	[17/5]	[17/5]
20 L – W 1961–86	0.00	3.78	10.57	19.28	21.70
	(0.00)	(0.90)	(1.26)	(1.52)	(1.32)
	[8/14]	[11/11]	[12/10]	[13/9]	[15/7]
10 L – W 1961–86	–4.69	–4.74	10.12	23.31	26.84
40 L – W 1961–86	–1.41	–0.96	3.08	8.79	16.66
20 L – W 1961–75	0.80	5.09	6.64	13.63	11.82
20 L – W 1972–86	–0.79	2.47	14.49	24.93	31.58

Note: The *t*-statistics have a Newey–West (1987) correction for overlapping observations. The data in the brackets are the number of replications for which the strategy earned cumulative positive or negative (+/–) returns after 12, . . ., 60 months into the test period.

It is often suggested that differences in beta risk may explain the performance gap between winners and losers (e.g., Chan; Ball and Kothari 1989). However, in the cross-section of returns, beta has almost no explanatory power in Germany (Frantzmann 1990). Therefore, we only considered this variable in the case of long-horizon contrarian portfolios. We estimated betas over five years for portfolios of 20 stocks. The winners' betas averaged 1.02 during the rank period. For losers, the average portfolio beta was 1.07. During the test periods, the respective betas were 0.93 and 1.10. If we split the sample into two subperiods (1965–1975 versus 1976–1986), the difference in rank-period betas between winners and losers was bigger in the first half: 0.87 versus 1.03. The test-period betas also differed by more: 0.84 versus 1.08. Yet, as mentioned earlier, the contrarian strategy was more profitable during the second half of the period.

A second way to judge the risk of the various investment strategies is to check whether their performance depends on the state of the macroeconomy. We employed the growth rate in industrial production, inflation, the Bundesbank discount rate, the slope of the term structure, and stock market performance to sort the rank and test periods in "good," "neutral," or "bad" states. In **Table 5**, we list the fraction of times, over 50 percent, that the strategy yielded a positive return. The left panel of Table 5 examines whether macro-conditions during the rank period can help to predict performance *ex ante*. The right panel asks whether certain states are associated with investment success *ex post*. As it happens, there are few negative numbers in Table 5. The momentum strategies performed well no matter the state of the economy. The contrarian strategy performed poorly when the discount rate was low and when long-term interest rates greatly exceeded short-term rates.

A final way to characterize and to judge the risk of the contrarian portfolios—a method that appeals to investment practitioners—is to examine the composition of the extreme portfolios. In **Table 6**, we list the two industries with the largest number of data points, by replication, and the corresponding

Table 5. Risk and Return by Macroeconomic State

	Rank Period					Test Period				
State	*IP*	π	*di*	*SL*	*%FAZ*	*IP*	π	*di*	*SL*	*%FAZ*
A. One-month momentum (360 replications)										
Good	11%	12%	7%	8%	3%	7%	12%	8%	10%	11%
Neutral	13	13	15	12	18	17	13	15	13	13
Bad	14	13	16	18	16	14	13	14	15	14
B. Three-month momentum (120 replications)										
Good	23	25	23	13	25	18	23	18	8	18
Neutral	10	18	3	15	18	20	15	13	20	15
Bad	18	8	25	23	8	13	13	20	23	18
C. Six-month momentum (60 replications)										
Good	30	5	20	25	30	10	10	5	20	20
Neutral	20	40	25	20	20	40	35	40	20	25
Bad	20	30	35	35	30	30	35	35	40	35
D. Twelve-month momentum (30 replications)										
Good	20	10	10	10	10	0	−10	−20	−10	10
Neutral	0	0	0	0	30	20	10	10	10	−10
Bad	10	20	20	20	−10	10	30	40	30	30
E. Sixty-month contrarian (22 replications)										
Good	21	21	−21	−21	36	21	50	36	36	36
Neutral	13	13	38	38	0	25	−12	13	13	13
Bad	21	21	36	36	21	7	21	7	7	7

Note: *IP* = growth rate in industrial production, π = the inflation rate, *di* = the Bundesbank discount rate, *SL* = the spread between long- and short-term interest rates on government instruments, and *%FAZ* = the returns on the FAZ Aktienindex. High *IP*, high *SL*, high *%FAZ*, low π, and low *di* were defined as good states. For the rank period, *di* and *SL* were observed during the last month; *IP*, π, and *%FAZ* were the growth rates over the duration of the period. For the test period, *di* and *SL* denoted the average monthly values; *IP*, π, and *%FAZ* represented 12-month growth rates (for the momentum strategies) or 6-month growth rates (for the contrarian strategies).

Table 6. Performance and Industry Composition of Contrarian Portfolios

Year	Winners		R_{rp}	R_{tp}	Losers		R_{rp}	R_{tp}
1965	U: 30%	Re: 20%	63%	47%	H: 25%	M: 25%	−63%	84%
1966	U: 30	R: 15	56	99	H: 25	M: 15	−65	71
1967	C: 20	B: 15	139	168	B: 35	C: 20	−43	150
1968	M: 35	B: 20	198	51	B: 30	H: 25	−46	55
1969	M: 30	C: 20	267	−3	Re: 30	B: 25	−35	7
1970	C: 35	M: 15	262	29	B: 25	Re: 20	−40	70
1971	C: 35	B: 15	336	16	B: 30	C: 20	−23	48
1972	C: 50	B: 15	299	5	Ch: 25	H: 10	−23	22
1973	C: 50	B: 20	226	38	M: 15	B: 15	−46	60
1974	C: 35	C: 20	111	60	M: 20	E: 15	−60	75
1975	B: 25	H: 15	209	24	C: 25	H: 15	−36	19
1976	B: 30	St: 20	156	49	C: 25	H: 25	−43	40
1977	Re: 15	St: 15	107	41	H: 30	C: 25	−52	14
1978	H: 25	St: 15	191	52	C: 25	H: 20	−39	26
1979	B: 20	U: 15	176	111	C: 35	E: 20	−43	111
1980	Re: 20	H: 15	165	173	C: 25	E: 15	−53	132
1981	Re: 25	H: 15	219	182	C: 20	St: 20	−50	194
1982	Re: 15	E: 15	214	90	H: 30	St: 25	−46	130
1983	B: 15	E: 15	222	96	St: 30	H: 20	−33	98
1984	E: 25	C: 15	396	124	H: 35	C: 15	−22	215
1985	B: 40	Au: 15	649	20	C: 40	Re: 20	9	165
1986	B: 45	E: 25	845	−17	H: 45	C: 20	8	143
Average five-year return			250%	66%			−38%	88%

Note: For each of 22 replications, which are identified by the last year of the five-year rank period, the table shows the percentage of the winner and loser portfolios made up by the top two industries. The industries and the fraction of companies for each industry listed in 1985 in the top segment of the FSE are as follows: Au (automobile), 6 percent; B (banking and insurance), 14 percent; Ch (chemical), 9 percent; Re (construction and real estate), 10 percent; C (consumer products), 16 percent; E (electrical), 6 percent; H (heavy machinery), 17 percent; M (metals and mining), 5 percent; R (retail and services), 5 percent; St (steel), 3 percent; and U (utilities), 9 percent. Also shown are the five-year rank-period and test-period cumulative buy-and-hold returns.

rank- and test-period returns. Banks, insurance firms, and companies that specialize in consumer products and heavy machinery appear often in the list; utilities, automobile companies, and retailing companies, almost never. Mining companies were important during the first half of the sample period. The industry composition of the momentum portfolios (not shown in Table 6) also offers some interesting insights. Some segments (banking, chemicals) were underrepresented, while others (heavy machinery, electrical) were overrepresented. This point may warrant further research.

Predictable Reversals in Earnings and Prices. To repeat, many papers in the literature justify the seeming profitability of contrarian strategies with differences in risk between winner and loser firms. Past performance, company size, and the level of share prices are interpreted as proxy variables for risk. The behavioral theory that led to the discovery of price reversals suggests, however, that many investors systematically misperceive the earnings process. Long-horizon forecasts of earnings growth tend to be too optimistic and too extreme. This extrapolation bias, caused by the so-called representativeness heuristic, even applies to experts, such as security analysts (De Bondt and Thaler 1990). The bias may be turned into profit by systematically betting against analyst predictions (De Bondt 1992).

In sum, it seems that investors are too pessimistic about the prospects of past loser companies and too optimistic about past winners. They cannot distinguish good (bad) companies from good (bad) stocks, and they do not perceive the general mean reversion in earnings. Loser companies objectively "look" bad, even if in efficient markets that fact should not be relevant for future prices and even if earnings are likely to rebound. Winner companies, in contrast, experience rapidly growing earnings

and become "glamour stocks." One way to test this behavioral theory is to check for mean reversion in the earnings of the winner and loser firms that make up the winning arbitrage portfolios.

Table 7 shows earnings, sales, and differential growth in assets, sales, and sales margins (from the rank to the test period) for winners and losers. We list the averages for every replication of the contrarian strategy. Over the 1961–91 period, the five-year growth rate of the assets of winners exceeded the growth rate of losers by 24 percent. For sales, the differential was 15 percent. Thus, in terms of their business fundamentals, past winner firms definitely looked better than past losers. Note also, however, how from the rank to the test period, the average sales margins of losers grew faster than the margins of winners.[16]

Table 8 reports average earnings, earnings/assets, and sales by rank and test year. Once again, we find that from the rank to the test period, the sales of winners grew more than the sales of losers. The picture is quite different, however, for earnings and earnings margins. On average, the income of winners rose 58 percent. For losers, the growth rate was 134 percent. These changes in profits rationalize predictable price reversals, if the market is naively fixated on earnings.

A final piece of evidence that supports our arguments relies on counts of the number of year-to-year earnings increases (or the number of increases in earning margins and sales) for winner and loser stocks. As seen in Panel B of Table 8, during the rank period, the average winner firm was more likely to announce an earnings increase than the average loser firm. (The chances were 12 percent better.) This changed during the test period. Of the loser firms, 62 percent announced earnings increases, whereas only 56 percent of the winners experienced gains. If investors are repeatedly surprised by the movements in profits, price reversals must follow.

Table 7. Earnings, Sales, Assets, and Profit Margins for Prior Winner and Loser Companies in Contrarian Portfolios, 1961–91

	Number of Observations and Delistings			Earnings (DM millions)		Sales (DM millions)		Differential Growth		
								Assets (DM millions)	Sales (DM millions)	Margins[a]
Year		W	L	W	L	W	L	L – W	L – W	L – W
1965	201	2	0	16	5	308	218	–31.9	–35.0	0.3
1966	201	4	2	11	31	176	1,115	–32.9	–64.1	0.0
1967	194	2	3	10	15	214	517	–10.4	–34.0	–1.7
1968	193	4	3	5	–15	240	569	–28.8	6.6	0.3
1969	193	3	2	10	11	369	368	–19.8	33.1	1.1
1970	181	4	2	5	27	278	738	27.5	25.7	0.2
1971	179	4	1	10	1	333	360	–4.1	–16.3	–.2
1972	169	4	1	10	89	310	2,798	–18.9	–50.5	0.4
1973	171	3	1	5	54	334	2,786	23.4	5.1	1.2
1974	170	2	2	33	–21	1,299	1,330	–0.3	57.4	0.8
1975	173	2	2	58	1	2,668	500	–40.4	6.9	–2.2
1976	175	2	1	34	7	1,897	552	–10.7	0.6	0.7
1977	173	1	2	72	5	2,069	618	12.3	–54.0	0.8
1978	174	2	1	47	–13	2,461	1,222	–27.1	–30.6	0.9
1979	191	0	2	67	–54	2,782	1,149	10.2	20.8	3.9
1980	192	0	0	25	5	1,107	2,658	–27.8	–25.9	1.9
1981	193	1	2	34	–3	1,852	3,449	–34.5	–39.6	1.8
1982	190	1	0	31	–26	1,948	3,429	–60.9	–27.6	1.4
1983	190	1	1	117	–50	7,536	4,224	–26.1	–30.5	0.7
1984	193	1	1	122	35	5,159	2,753	–93.7	–34.9	–1.2
1985	192	0	0	174	16	7,326	1,535	–64.4	–16.3	–0.2
1986	190	1	0	137	24	6,787	2,728	–41.8	–30.0	0.4
Means				47	7	2,152	1,619	–24.1	–14.8	0.5

[a]Earnings/sales × 100.

Note: Each replication is identified by the last year of the five-year rank period.

Table 8. Changes in Earnings and Sales for Prior Winner and Loser Companies in Contrarian Portfolios from Rank to Test Period
(DM millions except as noted)

	Earnings		Earnings/Assets		Sales	
Year	W	L	W	L	W	L
A. Average changes						
Rank year –4	25	12	2.79%	2.03%	1,380	1,207
Rank year –3	33	17	1.93	1.91	1,641	1,313
Rank year –2	40	11	3.14	1.71	1,819	1,442
Rank year –1	41	9	2.84	1.48	1,959	1,556
Rank year 0	47	7	3.07	1.36	2,152	1,619
Test year +1	49	15	2.71	2.00	2,245	1,723
Test year +2	49	23	2.73	1.92	2,433	1,781
Test year +3	64	32	3.26	2.22	2,778	1,945
Test year +4	65	29	3.03	2.14	3,015	2,121
Test year +5	66	32	2.65	1.94	3,319	2,368
Mean for 10 years	48	19	2.82	1.87	2,274	1,708
Mean, rank period	37	11	2.75	1.70	1,790	1,427
Mean, test period	59	26	2.88	2.04	2,758	1,988
Change	+58%	+134%	+4%	+20%	+54%	+39%
B: Number of changes[a]						
Observations with an increase						
Rank period	66%	54%	56%	51%	82%	65%
Test period	56	62	48	59	73	68
Difference	–10%	+8%	–8%	+8%	–9%	+3%

[a]Percentages are averages for the rank and test periods and across replications.

Conclusion

We studied all major companies listed on the FSE for the 1961–91 period. Momentum and contrarian strategies appeared to beat a passive approach that invested in the market index. We tried to reconcile the results with standard theories, as well as with known price anomalies. However, factors such as beta, risk, or firm size do not easily account for the results. Because several of the strategies require limited trading, their implementation costs are modest. We conclude, therefore, that the results are economically meaningful—that is, substantial enough to be of interest to portfolio managers.

From the viewpoint of behavioral finance, what is perhaps most surprising is how closely the results for Germany match the findings for the United States—even though equity markets are organized very differently and even though there are profound differences in the social, cultural, and economic environment. Maybe general traits in human behavior and psychology overcome these differences and ultimately drive the speculative dynamics of asset prices in world financial markets.

We thank the Deutsche Finanzmarktdatenbank at the University of Karlsruhe for providing data. We are also grateful to Oliver Bromann, Andreas Kappler, Olaf Korn, Ute Pieper, Thomas Schlaak, Esther Schweizer, and Sara Walker for comments and assistance. Earlier versions of this article were presented at CentER (the Netherlands), the Sixth Symposium on Finance, Banking, and Insurance in Karlsruhe, the ENTER-JAMBOREE at the University of Mannheim, the Eighth Colloquium on Empirical Capital Market Research of the German Science Foundation, and the joint research seminar of DePaul University and the Federal Reserve Bank of Chicago. We thank seminar participants at the University of Colorado, the University of Geneva, Indiana University, Oxford University, the Norwegian School of Management, and the Stockholm School of Economics. Much of this research was done while Werner De Bondt was a member of the IEW at the University of Zurich. Related behavioral research in Germany may be found at www.behavioral-finance.de. For a more detailed report of the results reported here, please e-mail Werner De Bondt at wdebondt@bus.wisc.edu.

Notes

1. Momentum in 12-month returns was also reported in De Bondt and Thaler (1985, Table 1). The findings were not emphasized, however, since long-horizon price reversals were the focus of the paper.
2. This is of interest in view of Conrad and Kaul's (1993) critique of the profitability of contrarian strategies. See, however, Loughran and Ritter (1996).
3. The speculative dynamics of stock prices have been studied for countries other than the United States. See, for example, Rouwenhorst (1998) for evidence of momentum. Earlier research for Germany is found in Meyer (1994) and Stock (1988). For a survey of the international evidence, see De Bondt (1999).
4. Much of the discussion in this section is based on materials published by Deutsche Boerse AG (1994).
5. Besides the FSE, there are other regional exchanges in Germany (e.g., in Munich), but their combined market share is small.
6. For more institutional details and discussion of the use of batch auctions in German securities markets, see Haller and Stoll (1989) and Schmidt, Oesterhelweg, and Treske (1995).
7. As mentioned earlier, the DAX share price index is a product of Deutsche Boerse AG. It is a value-weighted index of 30 blue-chip German companies. The index was retroactively linked to the Boersen-Zeitung index that started in 1959. Its value was set at 1,000 for the last trading day of 1987. Compared with the DAX, the FAZ Aktienindex is a broader value-weighted index of 100 large firms. It is published by the *Frankfurter Allgemeine Zeitung*, one of the main German newspapers. (For details, see copies of the newspaper of December 31, 1988, and September 1, 1993.) To put the value of publicly listed German companies into perspective, it is interesting to observe that the total market capitalization of German shares at the end of 1996 represented only 27 percent of GDP. For the United States, the comparable statistic was 122 percent; for Switzerland, 135 percent; and for Britain, 152 percent.
8. We defined recession years as years with negative growth in industrial production. Recessions were usually preceded by a sharp increase in inflation, and they were associated with a relative "high" in the Bundesbank discount rate and a relative "low" in the slope of the term structure (i.e., the differential between long-term and short-term interest rates).
9. The use of buy-and-hold returns is important in view of prior research by Conrad and Kaul (1993) and Barber and Lyon (1997). Buy-and-hold returns avoid biases in test statistics that result from the summation of monthly excess returns. We did not work with market model residuals or excess returns measured relative to the Sharpe–Lintner CAPM. However, as will be described, we did control for beta risk at the portfolio level.
10. We excluded securities with missing data for the rank period and/or the first month of the test period. If a stock had missing return data during the test period, then it was removed from the portfolio from that point on. We assumed that the security was sold at the last listed price. The sum was held in cash, with zero return, until the end of the test period. There was no rebalancing in the portfolios of any kind.
11. Kothari and Warner (1997) and others have recommended the use of nonparametic tests to judge long-horizon price performance.
12. Two comments: First, the excess returns were seasonal. A profit of 21.7 percent over five years is equivalent to an annually compounded return of 4.0 percent. About 2.7 percent of that return was earned in January. In December, the return was, on average, negative, –1.2 percent. Second, if we added (rather than multiplied) excess returns, the contrarian strategy earned 13.6 percent.
13. The two means are for the rank period. The difference between them was not statistically significant. The data were strongly influenced by the experiment with 1985 as the last year of the rank period. Without that replication, the average market value of equity was DM624 million for winners and DM603 million for losers. If we measured company size by the book value of equity, the average values for winners and losers were again statistically indistinguishable.
14. Average dividends per share were also lower for past losers (DM9) than for past winners (DM12). However, this measure confounded profitability with price effects.
15. Conrad and Kaul (1993) found that in the United States, minimum price changes, of one-eighth of a dollar, may cause a bias in the returns of low-priced stocks. This market micro-structure argument does not apply here, however. The reason is that the average stock price of loser stocks in Germany is about 80 times the level of what it is in the United States.
16. The results are not due to survivorship bias since, as Table 7 indicates, few firms—winners or losers—disappeared during the test period. Table 7 further shows that if we judge by sales, winners were larger firms, on average. (This was not the case in every single replication.) Other statistics confirm this. In the last year of the rank period, the average market value of winners was DM1,525 million. For losers, it was DM495 million. If we used book values, the results were similar. The average share price at the end of the rank period was DM484 for winners and DM152 for losers.

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