The Journal of Psychology and Financial Markets
2000, Vol. 1, Nos. 3&4, 176–192



# Home Bias in International Stock Return Expectations

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*Despite the advantages of international portfolio diversification, actual equity portfolio holdings reveal a strong bias towards domestic stocks. One hypothesis is that this bias can be explained by stock return expectations expressed in probability judgments. To test that hypothesis and to analyze the underlying effects that might cause distortions in investors' expectations, we conducted a cross country study in Germany and the U.S. comparing participants' judgments about an identical set of German and U.S. stocks.*

*Results show that both test groups feel more competent about domestic stocks. The asymmetric perception of competence is connected with an asymmetric assessment of probabilities. For both test groups subjective probability distributions of stock returns are significantly less dispersed and more optimistic for stocks associated with high competence levels than for stocks associated with low competence levels.*

Despite the advantages of international portfolio diversification actual equity portfolio holdings reveal a strong bias towards domestic stocks.[1] French and Poterba [1991] report that U.S. investors hold 93.8% of their equity portfolio in domestic stocks, Japanese investors 98.1%, and U.K. investors 82%. Various explanations have been suggested for rationalizing this finding. Among the possible explanations are monetary investment barriers, regulatory investment barriers, political risk, deviation from purchasing power parity, and asymmetric information (see Stulz 1995 and Lewis 1999 for reviews). Though in principle all of these effects may induce a home bias in equity portfolios, empirical evidence shows that none is sufficient large to explain the magnitude of the observed home bias. Thus, the home bias puzzle still remains unsolved. Asymmetric expectations would be a straightforward explanation for this puzzle. To investigate whether stock return expectations expressed by probability judgments actually reveal asymmetries of that kind we conducted a cross country study in Germany and the U.S. comparing participants' judgments about an identical set of German and U.S. stocks. In particular, we analyze whether people's probability distributions reveal systematic asymmetries in dispersion and in location. Moreover, we investigate what effects in individual judgment might cause such distortions.

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## Past Explanations

Various imperfections in international stock markets have been proposed to explain the observed pattern in equity holdings. Monetary investment barriers such as differences in transaction costs or unfavorable taxation may lead to imperfectly diversified portfolio holdings as captured, for example, in equilibrium models by Black [1974] or Stulz [1981a]. However, Cooper and Kaplanis [1994] find that for reasonable levels of risk aversion 'deadweight' costs such as withholding taxes or additional foreign transaction costs are too low to explain the observed pattern in international equity portfolios. Tesar and Werner [1995] show that turnover rates are significantly higher for foreign stocks than for domestic stocks, which does not support an explanation by transaction costs either. Another obstacle for foreign equity investment would be regulatory investment barriers. Particular groups of investors, such as insurance companies or pension funds, are still subject to rather restrictive regulations (see Davis 1991). Overall, however, regulatory investment barriers should not hinder foreign equity investment any more since developed financial markets have been widely deregulated during the last decade. Political risk might be an issue for investments in emerging stock markets; however, it seems to be negligible for investments in developed countries.

Another potential explanation is based on deviations from purchasing power parity. Adler and Dumas [1983] or Stulz [1981b] present models incorporating deviations from purchasing power parity and inflation risk against which investors try to hedge. However, Cooper and Kaplanis [1994] show that deviations from

purchasing power parity in combination with inflation risk may rationalize the observed equity holdings only for very low levels of risk aversion.[2] On the other hand, as Glassman and Riddick [1996] point out, the assumption that purchasing power parity holds would exaggerate the degree of the home bias. Thus all of the effects mentioned so far could induce a home bias in equity portfolios, but empirical evidence at hand shows that none seems to be sufficient large to explain the magnitude of the home bias.

## Asymmetric Expectations

A straightforward explanation of the observed equity holdings would be asymmetric expectations. French and Poterba [1991] show that observed portfolio holdings could be explained by domestic investors holding more optimistic expectations about domestic stocks than about foreign stocks. Informational asymmetries are normally considered to be the underlying reason for such differences. Gehrig [1993] or Brennan and Cao [1997] derive a home bias in equity portfolios in a noisy rational expectation framework based on the assumption that domestic and foreign investors are distinguished by the precision of their information. (Precision is defined in Gehrig as an inverse of standard deviation.) Levy and Livingston [1995] show in a mean-variance portfolio optimization framework that superior information about a specific asset, expressed either by lower expected standard deviation or by higher expected return, may be a strong reason not to diversify.[3] Thus observed portfolio holdings could readily be explained by international investors holding systematically different expectations which is the key assumption in information based models.

The empirical question remains whether expectations actually reveal systematic heterogeneities of that kind. In this paper we seek to check whether there is any evidence for such an assumption. We investigate in a cross country study conducted in Germany and the U.S. whether expectations about domestic and foreign stock returns expressed by individual probability judgments exhibit differences which may contribute to explain the observed pattern of equity holdings. Particularly we investigate whether people's subjective probability distributions on average exhibit systematic differences in location and in dispersion. Moreover, we address the question of what effect may cause such distortions. Extending the work by Heath and Tversky [1991] on the relation between perceived competence and preference we hypothesize that people's perception of competence, i.e. their perception of knowledge or familiarity, might influence probability estimations in a corresponding way.

The results show that people feel significantly more competent about domestic stocks than about foreign stocks. The perception of competence in turn seems to have a systematical influence on people's expectations expressed by the corresponding subjective probability distributions. For both test groups subjective probability distributions of stock returns are significantly less dispersed for stocks associated with high competence levels than for stocks associated with low competence levels. Furthermore, stocks associated with high competence levels are judged significantly more optimistically by both test groups than stocks associated with low competence levels. The same asymmetries apply comparing domestic stocks and foreign stocks. As documented by psychological research the observed patterns seem to be rather stable effects in individual judgment. These findings support the assumption of asymmetric expectations in international stock markets and may contribute to explain the observed home bias in international equity portfolio holdings according to the models discussed above (e.g. French and Poterba 1991, Gehrig 1993, Levy and Livingston 1995, Kang and Stulz 1997).

The paper proceeds as follows: In the first section we discuss in general the research approach and elaborate on three research hypotheses that guide the analysis. The second section explains the research design for testing the hypotheses. In the third section results are presented and discussed. The final section concludes with a short summary and a discussion of the results.

## Individual Probability Judgment and Research Hypotheses

Unfortunately, little is known about expectation formation in international stock markets.[4] However, there is a large literature on expectation formation in general. In economic research, for example, it is shown that price forecasts typically violate rationality of expectations (see Lovell 1986 for a review). The obvious lack of rationality of expectations evokes the question whether expectations in international stock markets exhibit distortions that may induce a home bias in equity portfolios. According to the models cited above the observed home bias could be explained by domestic investors holding more precise or more optimistic expectations about domestic stocks than about foreign stocks. Whether people's expectations actually exhibit asymmetries of that kind is the basic research question we want to address. Expectations are represented by probabilistic forecasts, in the form of subjective probability distributions.

Answering this basic question we address the underlying problem of what effect might cause such asymmetries in subjective probability distributions. Casual observations suppose that investors on average feel more competent in estimating future stock prices

of domestic stocks than future stock prices of foreign stocks, i.e. they consider their knowledge and forecasting skills to be higher for domestic stocks than for foreign stocks. The feeling of competence seems to discriminate between domestic and foreign stocks. It can be interpreted as a proxy for the degree of uncertainty people associate with a particular investment decision. Whether the perception of competence is based on actual expertise or not, it is expected to have a major influence on people's decision. Decision theory distinguishes between preferences expressed by choices and underlying beliefs expressed by probability judgments. So far it has been shown that perceived competence has an important impact on people's preferences. Heath and Tversky [1991] show that people on average prefer to bet on their own judgment, e.g. on the outcome of a football match with an individually assessed probability of winning, over a matched *equiprobable* chance event when they consider themselves competent about the uncertain event being judged. They are even willing to pay a premium to bet on the event they feel compentent about. Otherwise, if people do not feel competent, they prefer betting on the equiprobable chance event. This effect can not be explained by probabilities. It shows that people's preferences are not fully expressed by their beliefs or expectations. The effect of perceived competence on people's preferences has been confirmed in a number of studies e.g. by Fox and Tversky [1995] or Keppe and Weber [1995].

We extend the analysis by investigating whether the perception of competence also has a systematic impact on people's explicit beliefs which are expressed by probability judgments. We hypothesize that perceived competence systematically influences the shape of people's probability distribution. This is the second research question we want to address. Hypothesis 1 serves as a basis for the following analysis.

**Hypothesis 1: International Stocks and Competence**

People consider themselves on average more competent in forecasting domestic stock prices than in forecasting foreign stocks prices.

The hypothesized asymmetry in perceived competence may either be due to true informational asymmetries or to various psychological biases. Psychological research reports e.g. that people tend to overestimate their own knowledge and abilities. This behavioral trait termed overconfidence may very well be differently marked for foreign and domestic stocks.[5] However, for our purpose it does not matter whether the perception of competence is due to true information or due to psychological biases. Probability judgments are affected in a similar way. People are by definition unable to ex ante distinguish different sources of perceived competence.

It remains the question in which way the perception of competence might influence people's probability estimates. Generally, we expect the perception of competence to lead to tighter, less dispersed probability distributions. This presumption corresponds to the basic intuition that more detailed information generally evokes more precise judgments. Related studies on the accuracy of probabilistic expert judgments reveal that probability distributions of so called "experts" which are presumed to be competent in a particular field tend to be tighter, i.e. less dispersed, than probability judgments of novices which are assumed to be rather unfamiliar with the problem. See e.g. Yates, McDaniel and Brown [1991], Önkal and Muradoglu [1994, 1996], Stael van Holstein [1972] for probabilistic stock prices judgements, Whitecotton [1996], Yates, McDaniel and Brown [1991], for probabilistic earnings forecasts, and Spence [1996] for real estate valuation. Applied on international equity investment decisions this summarizes to the following research hypothesis:

**Hypothesis 2: Competence and Dispersion**

Subjective probability distributions of stock returns exhibit on average higher dispersion for stocks associated with low competence levels than for stocks associated with high competence levels.

We do not expect the perception of competence to have a systematical impact on the location of the probability distribution. There seems to be no obvious reason why the location of a distribution should systematically depend on the perception of competence. Informational asymmetries for example can hardly explain any systemtical differences in location since there seems to be no reason why on average people's information should differ. Nevertheless we will check whether we can find any evidence for such an effect. Particularly, we test whether high competence stocks are judged more optimistically than low competence stocks, which would be a straightforward explanation of the observed equity holdings assuming hypotheses 1 to hold. This leads to the following research hypothesis:

**Hypothesis 3: Competence and Location**

Locations of subjective probability distributions of stock returns are independent of the associated levels of perceived competence.

## Research Design

A direct test of the hypotheses stated above requires that researchers elicit competence judgments and subjective probability distributions of domestic and foreign investors for an identical set of domestic and foreign stocks. In December 1996 we conducted such a cross country study in Germany and the U.S. among participants of graduate level investment courses at the University of Mannheim and the Ohio State University at Columbus.[6] The identically designed studies were run after class using a two page questionnaire in English and in German respectively. Subjects were paid a flat fee of five dollars or six deutchemarks for participation. A sample questionnaire is attached in the appendix. A research design with two independent test groups, one domestic and one foreign, allows two independent tests of the research hypotheses and a comparison of results across test groups which is important for a clear cut interpretation.

Each participant had to judge three U.S. and three German stocks, the Dow Jones Industrial Index and the German stock market index DAX. Four different versions of the questionnaire were used, differing only by the stocks selected. Thus, altogether twelve German stocks and twelve US stocks were examined. All stocks are listed at the New York Stock Exchange and the Frankfurt Stock Exchange respectively. They were chosen from the 1996 Fortune Global 500 list which ranks companies by total revenues: Within each industry the largest German exchange listed corporation and the largest U.S. exchange listed corporation were paired, also the second largest German corporation and the second largest U.S. corporation, and so forth. From all such pairs twelve were chosen randomly and assigned to one of the four versions of the questionnaire. This selection procedure ensures that German and U.S. stocks are comparable in relative size and industry, which in turn ensures that there should be no bias in familiarity due to the selection of stocks.

For each of the six stocks and two stock market indices participants were asked to judge their personal competence estimating the stock price in three month, i.e. by March 3, 1997, on a seven point scale from 0 (not competent at all) to 6 (very competent). In order to allow a clear ranking if competence judgments are equal they were asked to order the six stocks according to their competence ratings from rank 1 (highest perceived competence) to rank 6 (lowest perceived competence).

Next, people were expected to give probability judgments about stock price changes within the next quarter for each of the six stocks. Each estimate was for the price change from November 27, 1996 to March 3, 1997 denominated in local currency, i.e. U.S. stocks in Dollar, German stocks in Deutsche Mark. Two different elicitation methods were applied in order to cross check the results. For each stock the subjective probability distribution of the stock price change by March 3, 1997 was elicited applying the design by Yates, McDaniel and Brown [1991] and Önkal and Muradoglu [1995, 1996]. Participants were asked to judge the probability that the stock price change will be within a given range $I^j$ for each of six ranges $I^1,\ldots, I^6$ which partition the return continuum [The stock price will decrease by more than 10%, …decrease by 10% to 5%, …decrease by 5% to 0%, …increase by 0% to 5%, …increase by 5% to 10%, …increase by more than 10%]. Participants were reminded that the total of judged probabilities should equal 100%.

Additionally, participants were asked to directly forecast future stock prices in the stocks local currency. Particularly, we asked for the 0.5 quantile (For which value is it as equally likely that the stock price will be above respectively below this value), the 0.1 quantile (Which value do you expect the stock price with high probability [90%] not to fall short of?) and the 0.9 quantile (Which value do you expect the stock price with high probability [90%] not to exceed?). The stock prices of November 27, 1997 were given as reference values. In order to control for different expectations about dividend payments we asked people if their answers explicitly include a stock price decrease due to expected dividend payments by March 3, 1997 and if so, how much.

Summarizing, a complete data set of subject $s$ about stock $i$ consists of the following judgments: competence rating $C_{s,i}$, rank $R_{s,i}$, stock price change probabilities $p^1_{s,i},\ldots, p^6_{s,i}$, price quantiles $X^{0.1}_{s,i}, X^{0.5}_{s,i}, X^{0.9}_{s,i}$, dividend adjustment $Div_{s,i}$. Finally, the corresponding values for the Dow Jones Industrial Index and the DAX were elicited. The only difference is that we applied a four interval partition for probability estimates, i.e. we merged interval $I^1$ with $I^2$ and $I^5$ with $I^6$. We decided to additionally ask for stocks market indices to check whether the hypothesized effects for single stocks also hold for stocks market indices. If so we expect these effects to be less pronounced since differences in perceived competence are presumably lower.

The German group consisted of 101 participants and the U.S. group of 78 participants, which split according to 26, 25, 26, 24 and 19, 19, 21, 19 on the four versions. Thus we got 606 stock price judgments for the German group and 468 stock price judgments for the US group. Incomplete stock price judgments or judgments not satisfying the order relation "0.1 quantile < 0.5 quantile < 0.9 quantile" have been completely eliminated from the analysis.[7]

## Results

According to the research approach stated in the second section, the following analysis focuses on test-

ing hypotheses 1 to 3 for single stock data. To further interpret the findings we will subsequently discuss corresponding results for stock market indizes, compare people's probability judgements to the distribution of historical returns and determine ex post the forecasting accuracy of the probability judgments.

### Hypothesis 1—Findings About Competence

First we turn to Hypothesis 1, which claims that people on average consider themselves more competent forecasting domestic stock prices than forecasting foreign stocks prices. Table I shows means of judged competence for single stock judgments of the German and the U.S. group. It can be seen in Table Ia that the U.S. group judges its competence for U.S. stocks significantly higher than for German stocks ($C_{US,US}$ = 3.11, $C_{US,GER}$ = 1.76, $p < 0.01$; p-values refer to Wilcoxon ranksum tests). Vice versa, the German group judges its competence for German stocks significantly higher than for U.S. stocks ($C_{GER,US}$ = 1.07, $C_{GER,GER}$ = 2.44, $p < 0.01$). Accordingly, the U.S. group ranks U.S. stocks better than German stocks, and the German group ranks German stocks significantly better than U.S. stocks. These observations strongly support Hypothesis 1. People feel on average more competent about domestic stocks than about foreign stocks. In order to check whether results are driven by particular groups of stocks we split the full sample and compare results for the four versions of the questionnaire. It can be seen that competence judgements are very similar across versions. For each version all results are in the same direction as indicated by Table I. Besides comparing judgments about domestic and foreign stocks within a test group, the research design allows to compare judgments about an identical set of stocks across test groups. As expected Americans feel more competent about U.S. stocks than Germans ($C_{GER,US}$ = 1.07, $C_{US,US}$ = 3.11, $p < 0.01$). The inverse relation holds for German stocks ($C_{GER,GER}$ = 2.44, $C_{US,GER}$ = 1.76, $p < 0.01$). Thus competence ratings for domestic and foreign stocks display a strict cross pattern. Averaging over all stocks, it is generally noticed that the U.S. group exhibits higher competence judgments (mean = 2.44) than the German group (mean = 1.76).

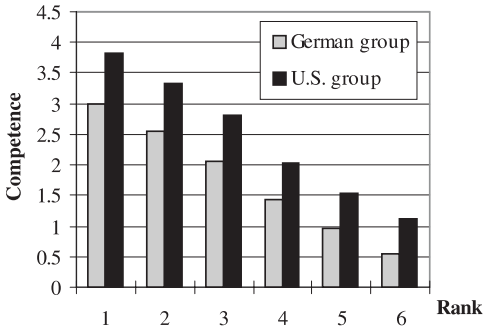
Besides comparing German stocks und U.S. stocks we will compare other subsets of stocks based on people's rank judgments throughout the following analysis. For comparison the corresponding competence judgments are also given in Table I. Table Ib displays the corresponding values for the set of high ranked stocks, i.e. the set of all single stock judgments referring to stocks individually assigned to rank 1, rank 2, or rank 3 (upper half of each ranking), and the set of low ranked stocks, i.e. the set of all single stock judgments referring to stocks assigned to rank 4, rank 5, or rank 6 (lower half of each ranking). Table Ic reports numbers for the subset of all top ranked stocks, i.e. the set of all single stock judgments referring to stocks individually assigned to rank 1, we get Rank 6 for subset of all lowest ranked stocks, i.e. the set of all single stock judgments referring to stocks assigned to rank 6. Figure 1 displays the general relationship between competence judgments and stock ranking for the German group and the U.S. group which by definition is monotonically decreasing. Combining a country based partition and a rank based partition Table Id compares competence judgments for the set of all highest ranked German stocks, which comprise judgments about the highest ranked German stock from each individual ranking, and the set of all lowest ranked German stocks, which comprise judgments about the lowest ranked German stock from each individual ranking. Table Ie compares

**Table 1.** *Competence Judgments for Single Stocks*

| | German test group | | U.S. test group | |
|---|---|---|---|---|
| a) | German stocks | U.S. stocks | German stocks | U.S. stocks |
| Competence | *2.44* | *1.07* | *1.76* | *3.11* |
| Rank | *2.32* | *4.68* | *4.46* | *2.55* |
| b) | High ranks | Low ranks | High ranks | Low ranks |
| Competence | *2.53* | *0.98* | *3.33* | *1.55* |
| c) | Top rank | Lowest rank | Top rank | Lowest rank |
| Competence | *3.00* | *0.54* | *3.84* | *1.11* |
| d) | Top ranked German stock | Lowest ranked German stock | Top ranked German stock | Lowest ranked German stock |
| Competence | *2.99* | *1.83* | *2.48* | *1.16* |
| e) | Top ranked U.S. stock | Lowest ranked U.S. stock | Top ranked U.S. stock | Lowest ranked U.S. stock |
| Competence | *1.68* | *0.68* | *3.75* | *2.44* |

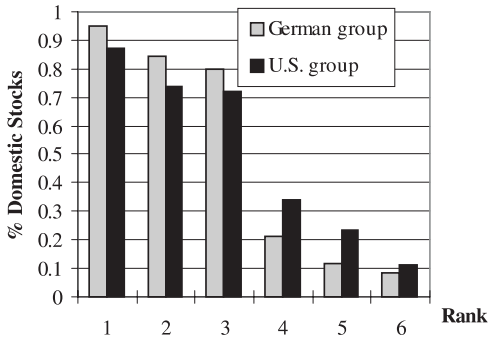
*Note:* Mean competence judgments on a scale from 0 (not competent at all) to 6 (very competent) for various subsets of stocks derived from the stock's country of origin or people's competence ranking.

**FIGURE 1**
**Rank and Competence Judgments for Single Stocks**




*Note:* Mean competence judgments on a scale from 0 (not competent at all) to 6 (very competent) about stocks placed on the indicated ranks for the German and the U.S. test group.

**FIGURE 2**
**Ranks and Share of Domestic Stocks**




*Note:* Share of domestic stocks placed on the indicated ranks for the German and the U.S. test group.

the corresponding sets for U.S. stocks. Table Id and Ie allow comparisons *within* the set of stocks from one country.

Figure 2 shows that higher ranked stocks are predominantly domestic stocks. The share varies between 94.7% for German group top ranked stocks and 8.4% for German group lowest ranked stocks. It is 87.1% for German group high ranked stocks and 11.4% for U.S. group high ranked stocks.

### Hypothesis 2—Findings About Dispersion

Testing subjective probability distributions of stock returns for differences in dispersion requires the specification of appropriate measures of dispersion. Instead of fitting the very differently shaped $(p^1_{s,i},\ldots,p^6_{s,i})$ raw data into one particular parametric distribution, which we do not know and which is certainly not the same for all judgments, we employ three simple nonparametric measures of dispersion directly derived from the data.[8] Comparing the three measures it should be noted that we use two types of data which allows us to cross check results across elicitation methods. Data type I is based on the direct elicitation of subjective probabilities, data type II on the direct elicitation of prices. Data type I is used for the first and the second measure, data type II for the third.

First, we calculate from the set of probabilities $p_{s,i} = (p^1_{s,i},\ldots,p^6_{s,i})$ assigned to the intervals $I^1,\ldots,I^6$ for each subject $s$ and each stock $i$ the standard deviation of probabilities according to $Std(prob)_{s,i} = \sqrt{\sum_{j=1}^{6}(p^j_{s,i}-\bar{p}_{s,i})^2 \cdot 1/6}$ with $\bar{p}_{s,i} = 1/6$. This measure summarizes the discrepancy between the forecaster's set of probabilities and a uniform (flat) set of probabilities.

Second, we calculate from the probabilities $p_{s,i} = (p^1_{s,i},\ldots,p^6_{s,i})$ the standard deviation of returns assuming a uniform distribution of probabilities within intervals, so that each interval $I^j$ can be characterized by its midpoint $\dot{r}^j$, according to $Std(return)_{s,i} = \sqrt{\sum_{j=1}^{6}(\dot{r}^j-\bar{r}_{s,i})^2 \cdot p^j_{s,i}}$ with $\bar{r}_{s,i} = \sum_{j=1}^{6}(\dot{r}^j \cdot p^j_{s,i})$ under identical assumptions.[9] *Std*(*return*) has a slightly different meaning than *Std*(*prob*). *Std*(*prob*) captures the concentration of a probability distribution measured by its deviation from a flat distribution, whereas *Std*(*return*) expresses the deviation from the mean. For normally distributed variables higher *Std*(*prob*) values mean lower *Std*(*return*) values. This relation, however, may not be valid for other types of distributions.

Third, we calculate the standard deviation of returns from the price estimates $X^{0.1}_{s,i}, X^{0.5}_{s,i}, X^{0.9}_{s,i}$. In order to work with returns, $X^{0.1}_{s,i}, X^{0.5}_{s,i}$, and $X^{0.9}_{s,i}$ are previously divided by the price of stock $i$ at the beginning of the study, $X_{0,i}$, which was given to the participants. Since we cannot make an assumption about a particular form of distribution for all subjective probability judgments we applied a simple discrete three-point approximation which Keefer and Bodily [1983] showed to fit well a variety of relevant probability distributions: $Std(point) = [(0.3 \cdot (X^{0.1}_{s,i}/X_{0,i})^2 + 0.4 \cdot (X^{0.5}_{s,i}/X_{0,i})^2 + 0.3 \cdot (X^{0.9}_{s,i}/X_{0,i})^2) - (Mean)^2]^{0.5}$ with $Mean = 0.3 \cdot (X^{0.1}_{s,i}/X_{0,i}) + 0.4 \cdot (X^{0.5}_{s,i}/X_{0,i}) + 0.3 \cdot (X^{0.9}_{s,i}/X_{0,i})$.[10]

Table II reports the corresponding medians for different sets of stocks.[11] It should be kept in mind that a tighter, less dispersed probability distribution means lower *Std*(*point*), lower *Std*(*return*), and higher *Std*(*prob*) values. Thus almost all numbers indicate higher dispersion for less well-known stocks. In more detail, German test group judgments reveal significantly higher dispersion for low ranked stocks than for high ranked stocks for all of the three measures (p-values all significant, all $p < 0.01$, Table IIa left side). This effect persists comparing top ranked stocks and lowest

**Table 2.** *Probability and Price Judgments for Single Stocks: Measures of Dispersion*

| | German test group | | | U.S. test group | | |
|---|---|---|---|---|---|---|
| a) | High ranks | Low ranks | p-value[a] | High ranks | Low ranks | p-value[a] |
| Std (prob) (–) | *0.134* | *0.118* | *<0.01* | *0.131* | *0.121* | *<0.01* |
| Std (return) (+) | *5.55* | *6.02* | *<0.01* | *5.73* | *5.98* | *<0.05* |
| Std (point) (+) | *7.32* | *8.32* | *<0.01* | *7.84* | *8.04* | *n.s.* |
| b) | Top rank | Lowest rank | p-value[b] | Top rank | Lowest rank | p-value[b] |
| Std (prob) (–) | *0.140* | *0.118* | *<0.01* | *0.148* | *0.112* | *<0.01* |
| Std (return) (+) | *5.58* | *6.02* | *<0.01* | *5.39* | *6.04* | *<0.01* |
| Std (point) (+) | *7.85* | *8.61* | *<0.05* | *8.05* | *8.24* | *n.s.* |
| c) | German stocks | U.S. stocks | p-value[c] | German stocks | U.S. stocks | p-value[c] |
| Std (prob) (–) | *0.138* | *0.114* | *<0.01* | *0.121* | *0.137* | *<0.10* |
| Std (return) (+) | *5.50* | *6.02* | *<0.01* | *5.97* | *5.89* | *n.s.* |
| Std (point) (+) | *7.14* | *8.63* | *<0.01* | *7.65* | *8.76* | *n.s.* |
| d) | Top ranked German stock | Lowest ranked German stock | p-value[d] | Top ranked German stock | Lowest ranked German stock | p-value[d] |
| Std (prob) (–) | *0.140* | *0.140* | *n.s.* | *0.131* | *0.105* | *<0.05* |
| Std (return) (+) | *5.58* | *5.50* | *n.s.* | *5.67* | *6.04* | *<0.05* |
| Std (point) (+) | *7.80* | *6.10* | *n.s.* | *7.46* | *7.97* | *n.s.* |
| e) | Top ranked U.S. stock | Lowest ranked U.S. stock | p-value[e] | Top ranked U.S. stock | Lowest ranked U.S. stock | p-value[e] |
| Std (prob) (–) | *0.121* | *0.111* | *n.s.* | *0.143* | *0.124* | *<0.05* |
| Std (return) (+) | *6.02* | *6.10* | *n.s.* | *5.53* | *5.93* | *<0.10* |
| Std (point) (+) | *8.31* | *9.75* | *<0.10* | *8.30* | *9.38* | *n.s.* |
| to c) | p-values comparing Germans about German stocks to U.S. about German stocks[f] | | | | | |
| | Std (prob): | *<0.01* | Std (return): | *<0.01* | Std (point): | *n.s.* |
| | p-values comparing Germans about U.S. stocks to U.S. about U.S. stocks[g] | | | | | |
| | Std (prob): | *<0.05* | Std (return): | *<0.05* | Std (point): | *n.s.* |

*Note:* Median measures of dispersion based on people's price estimates *Std(point)* and probability estimates *Std(prob)*, *Std(return)* for various subsets of stocks derived from the stock's country of origin or people's competence ranking. (+) Higher number equals higher dispersion, (–) Lower number equals higher dispersion. Entries are medians and significance levels. Std(return) and Std(point) entries are in percent. P-values refer to one sided Wilcoxon rank sum tests.

[a]Null: Dispersion low ranks less or equal to dispersion high ranks. [b]Null: Dispersion lowest rank less or equal to dispersion top rank. [c]Null: Dispersion foreign stocks less or equal to dispersion domestic stocks. [d]Null: Dispersion lowest ranked German stock less or equal to dispersion top ranked German stock. [e]Null: Dispersion lowest ranked U.S. stock less or equal to dispersion top ranked U.S. stock. [f]Comparing German test group judgments about German stocks to U.S. test group judgments about German stocks under the null: Dispersion foreign stocks less or equal to dispersion domestic stocks. [g]Comparing German test group judgments about U.S. stocks to U.S. test group judgments about U.S. stocks under the null: Dispersion foreign stocks less or equal to dispersion domestic stocks.

ranked stocks (p-values all significant, two of three $p < 0.01$, Table IIb left side). Judgments by the U.S. group generally support this effect. All numbers in Table IIa and IIb confirm hypothesis 2 in direction (p-values *Std*(*prob*) and *Std*(*return*) all significant, three of four $p < 0.01$, *Std*(*point*) not significant, Table IIa and IIb right side). Since the set of high ranked stocks is largely similar to the set of domestic stocks similar patterns in judgments can be found comparing domestic stocks and foreign stocks. All values except for U.S. test group's *Std*(*point*) lead in the direction indicated above (German group: p-values all significant, all $p < 0.01$, Table IIc left side; U.S. group: *Std*(*prob*) $p < 0.10$, rest not significant, Table IIc right side). To check whether results are actually driven by perceived competence we compare for both test groups the set of each participant's highest ranked German stock to the set of each participant's lowest ranked German stock (Table IId). Corresponding results for U.S. stocks are also reported (Table IIe). All numbers except for German test group's German stocks reveal an effect of perceived competence in the direction indicated by the results above. Significance levels are generally weaker which is in part due lower numbers of observations per comparison. Comparing results *across* test groups for identical sets of stocks we find that U.S. judgments about U.S. stocks are significantly less dispersed than German judgments about U.S. stocks for measures based on direct probability assessments $p_{s,i} = (p^1_{s,i},\ldots, p^6_{s,i})$. The inverse relation holds for German stocks (p-values indicated at the bottom of Table II). Generally, our data supports hypothesis 2. Subjective probability distributions for high competence stocks on average seem to be less dispersed than such for low competence stocks.[12]

Moreover, we checked our results with data from an unrelated study by Löffler and Weber [1997] who asked 106 German financial professionals participating in a regular financial market survey for their expectations about various German stock returns. Though

the research design was somewhat different, e.g. employing domestic stocks only and asking people how certain they feel about forecasts instead of asking for explicit competence judgments, similar patterns in investors' probability estimates can be found in the data. Particularly, judgments comparable to our $X^{0.1}$, $X^{0.5}$ and $X^{0.9}$ estimates are significantly tighter for stock price estimates investors rated to be more certain. Therefore a similar bias seems to apply for professional investors.

## Hypothesis 3—Findings About Location

In order to test whether probability distributions reveal any systematic shift in location, we use two measures of expected return computed directly from our data. Again it should be noted that the measures are based on two different types of data. Data type I is used for the first measure, data type II for the second.

First, we calculate the mean return from $p_{s,i} = (p^1_{s,i},\ldots,p^6_{s,i})$ under the assumption of a uniform distribution within each interval $Mean(return)_{s,i} = \sum_{j=1}^{6}(\dot{r}^j \cdot p^j_{s,i}) + Div_{s,i}/X_{0,i}$ with $Div_{s,i}$ being the individually expected price decrease due to dividend payments in the forecasting period and $X_{0,i}$ the price of stock $i$ at the beginning of the study which was given to the participants.

Second, we determine the mean return from $X^{0.1}_{s,i}, X^{0.5}_{s,i}, X^{0.9}_{s,i}$ for each subject $s$ and each stock $i$ again employing the three-point approximation. In order to work with returns, $X^{0.1}_{s,i}, X^{0.5}_{s,i}$, and $X^{0.9}_{s,i}$ are previously divided by $X_{0,i}$: $Mean(point) = 0.3 \cdot X^{0.1}_{s,i}/X_{0,i} + 0.4 \cdot X^{0.5}_{s,i}/X_{0,i} + 0.3 \cdot X^{0.9}_{s,i}/X_{0,i} + Div_{s,i}/X_{0,i} - 1$.[13]

Practically, the consideration of dividend adjustments are negligible since participants state that they did not include any ex dividend adjustment in their estimates for all but 0.05% of the judgments. Principally, the consideration of dividend adjustments controls for the effect of different expectations about dividend payments within the forecasting period which we want to eliminate. Thus our measures of location reflect total returns, i.e. any individually expected ex-dividend price decrease included in the individual stock price estimation is eliminated by adding the explicitly stated dividend.

Table III reports the corresponding medians for different sets of stocks.[14] Surprisingly, all numbers reveal

**Table 3.** *Probability and Price Judgments for Single Stocks: Measures of Location*

| | German test group | | | U.S. test group | | |
|---|---|---|---|---|---|---|
| a) | High ranks | Low ranks | p-value[a] | High ranks | Low ranks | p-value[a] |
| Mean (return) | *1.75* | *0.75* | *<0.01* | *1.00* | *0.00* | *<0.01* |
| Mean (point) | *2.89* | *1.33* | *<0.01* | *2.64* | *1.34* | *<0.01* |
| b) | Top rank | Lowest rank | p-value[b] | Top rank | Lowest rank | p-value[b] |
| Mean (return) | *1.60* | *0.00* | *<0.01* | *1.23* | *0.00* | *<0.01* |
| Mean (point) | *2.98* | *0.78* | *<0.01* | *2.96* | *1.37* | *<0.01* |
| c) | German stocks | U.S. stocks | p-value[c] | German stocks | U.S. stocks | p-value[c] |
| Mean (return) | *1.50* | *0.75* | *<0.01* | *0.00* | *0.50* | *<0.05* |
| Mean (point) | *2.79* | *1.46* | *<0.01* | *1.42* | *2.50* | *<0.01* |
| d) | Top ranked German stock | Lowest ranked German stock | p-value[d] | Top ranked German stock | Lowest ranked German stock | p-value[d] |
| Mean (return) | *1.50* | *1.00* | *<0.10* | *0.30* | *0.00* | *<0.01* |
| Mean (point) | *2.89* | *2.37* | *n.s.* | *1.88* | *1.37* | *<0.10* |
| e) | Top ranked U.S. stock | Lowest ranked U.S. stock | p-value[e] | Top ranked U.S. stock | Lowest ranked U.S. stock | p-value[e] |
| Mean (return) | *1.35* | *0.00* | *<0.01* | *1.16* | *0.00* | *<0.01* |
| Mean (point) | *2.72* | *0.68* | *<0.01* | *2.89* | *2.15* | *n.s.* |
| to c) | p-values comparing Germans about German stocks to U.S. about German stocks[f] | | | | | |
| | Mean (return): | *<0.01* | | Mean (point): | *<0.01* | |
| | p-values comparing Germans about U.S. stocks to U.S. about U.S. stocks[g] | | | | | |
| | Mean (return): | *n.s.* | | Mean (point): | *<0.01* | |

*Note:* Median measures of location based on people's price estimates *Mean(point)* and probability estimates *Mean(return)* for various subsets of stocks derived from the stock's country of origin or people's competence ranking. Entries are medians and significance levels. Entries are in percent. P-values refer to one sided Wilcoxon rank sum tests.

[a]Null: Location high ranks less or equal to location low ranks. [b]Null: Location top rank less or equal to location lowest rank. [c]Null: Location domestic stocks less or equal to location foreign stocks. [d]Null: Location top ranked German stock less or equal to location lowest ranked German stock. [e]Null: Location top ranked U.S. stock less or equal to location lowest ranked U.S. stock. [f]Comparing German test group judgments about German stocks to U.S. test group judgments about German stocks under the Null: Location domestic stocks less or equal to location foreign stocks. [g]Comparing German test group judgments about U.S. stocks to U.S. test group judgments about U.S. stocks under the Null: Location domestic stocks less or equal to location foreign stocks.

a systematic shift in location. Both test groups independently show significantly more optimistic judgments for high ranked stocks than for low ranked stocks (p-values all significant, all $p < 0.01$, Table IIIa), an effect which persists comparing top ranked stocks and lowest ranked stocks (p-values all significant, all $p < 0.01$, Table IIIb), as well as domestic stocks and foreign stocks (p-values all significant, three of four $p < 0.01$, Table IIIc). Additionally, we compare for both test groups the set of highest ranked German stocks to the set of lowest ranked German stocks (Table IIId). Corresponding results for U.S. stocks are reported (Table IIIe). All numbers confirm that even within one country higher ranked stocks are judged more optimistically than lower ranked stocks (*Mean*(*return*): three of four $p < 0.01$, one $p < 0.10$; *Mean*(*point*): one $p < 0.01$, one $p < 0.10$, others not significant, Table IIId and IIIe). Comparing results *across* test groups for identical sets of stocks we find that Germans judge German stocks significantly more optimistically than Americans do, and vice versa (significance levels indicated at the bottom of Table III). Overall, the evidence rejects hypothesis 3. High competence stocks on average seem to be judged more optimistically than low competence stocks.[15] We will discuss this finding in more detail later.

Again, we checked the results with the data by Löffler and Weber [1997] who asked German financial professionals participating in a regular financial market survey for their expectations about various German stock returns. A similar shift in location can be found in the data. Particularly, judgments comparable to our $X^{0.1}$, $X^{0.5}$ and $X^{0.9}$ estimates reveal a positive shift in location for stock price estimates investors rated to be more certain. Thus a similar bias seems to apply for professional investors.

As already mentioned the results reported in Table II and Table III are based on two different types of data. Data type I comes from a direct elicitation of subjective probabilities, data type II from a direct elicitation of prices. Generally, results based on the two types are similar which supports the robustness of results. However, absolute values and significance levels differ to some extent. Comparing *Std*(*return*) to *Std*(*point*) and *Mean*(*return)* to *Mean*(*point)* reported medians are larger for measures based on price estimates than for measures based on probability estimates. Comparing numbers within persons, *Std*(*point*) is larger than *Std*(*return*) for 75.4% of the German and 71.6% of U.S. participants. *Mean*(*point*) is larger than *Mean*(*return*) for 57.5% of the German and for 60.5% of the U.S. participants. The substantial difference in measures of dispersion may in part be due to the technical feature that *Std*(*return*) has upper and lower bounds whereas *Std*(*point*) does not have an upper bound. Moreover, the price elicitation mode may generally support more extreme forecasts than the corresponding probability assignment mode. Besides those differences in absolute value the hypothesized effects of competence are less pronounced for measures based on price estimates than for measures based on probability estimates, i.e. at least for measures of dispersion significance levels are weaker. This may be due to other effects overlaying the hypothesized competence effect. Thus price estimates might be generated according to the anchoring and adjustment heuristic proposed by Tversky and Kahneman [1982] which may be rather similar for all stocks. $X_{s,i}^{0.5}$ may be anchored upon the historical price $X_{0,i}$, $X_{s,i}^{0.1}$ and $X_{s,i}^{0.9}$ may be derived by adjusting $X_{s,i}^{0.5}$ e.g. a constant percentage upwards and downwards. Additionally, results of price estimates may further be influenced by a size effect, i.e. a constant range of 10 $ is proportionally smaller for a stock price of 300 $ than for a stock price of 30 $. This effect becomes particularly relevant since a third of the German stocks actually have nominal values and stock prices about ten times larger than the other stocks. For these reasons measures based on probability estimates appear to be more robust and reliable than corresponding measures based on price estimates.

## Historical Data

In order to further interpret our data, we compare it to the distribution of historical returns which might be seen as a simple benchmark for investor's expectations, particularly for the dispersion of returns. Thus we compute for each stock *i* the distribution of historical returns in form of relative frequencies based on identical discrete return intervals $I^1,\ldots,I^6$ using 1985 to 1996 time series data of nonoverlapping quarterly total returns. Comparing measures of dispersion based on this historical return distribution $h_i = (h^1,\ldots,h^6)$ and measures based on subjective probability distributions $p_{s,i} = (p_{s,i}^1,\ldots,p_{s,i}^6)$, Table IV shows that individual probability judgments are by far too narrow and too concentrated. This supports previous findings by e.g. Alpert and Raiffa [1982].

If one market was historically more volatile than another, it might be rational to indicate more dispersed probability judgments for the first market than for the second market. However, such differences in historical data can at best explain one side of the observed cross pattern in dispersion but not both. In our case, the observed differences between historical measures of dispersion for U.S. stocks and for German stocks are not significant as Table IV reports. Nevertheless, to control for even slight differences in the historical distribution we divide *Std*(*return*) for each stock by the corresponding $Std(return)_{historical}$. Testing for differences in this corrected measure of dispersion yields the result that the pattern documented in Table II persists for both groups with almost unchanged significance levels.

**Table 4.** *Measures of Dispersion—Average Judgment and Historical Data*

| | German stocks | | | U.S. stocks | | |
|---|---|---|---|---|---|---|
| | **German group** | **U.S. group** | **Historical** | **German group** | **U.S. group** | **Historical** |
| Std (return) (+) | *5.50* | *5.97* | *9.00* | *6.03* | *5.86* | *9.08* |
| Std (prob) (–) | *0.138* | *0.121* | *0.082* | *0.113* | *0.137* | *0.096* |

*Note:* Median measures of dispersion based on people's probability estimates compared to median measures of dispersion based on historical relative frequencies of corresponding stock returns from quarterly nonoverlapping total return data 1985–1996. (+) Higher number equals higher dispersion; (–) Lower number equals higher dispersion.

Thus for the specific data at hand the consideration of historical data does not change results.

## Accuracy

Whether differences in judgments are due to real information asymmetries or due to pseudo information asymmetries caused by individual misevaluations remains unsolved by the preceding analysis. To address this problem we look at ex post accuracy of probability forecasts since superior information should be associated with superior forecasting accuracy on average. A useful tool for measuring overall accuracy of probability judgments is the probability score for multiple events (Brier score) calculated according to: $PSM(p,d) = \sum_{j=1}^{J}(p^j - d^j)^2$, where $p = (p^1,...,p^J)$ is the vector of judged probabilities for the intervals $I^1,...,I^J$ and $d = (d^1,...,d^J)$ is the corresponding outcome vector with $d^j = 1$ if the stock price change calculated from real stock prices at the beginning and the end of the survey period falls into the corresponding interval and $d^j = 0$ if not. Thus a lower *PSM* indicates higher accuracy with $0 \leq PSM \leq 2$. See Yates, McDaniel and Brown [1991] for further descriptions. Calculating the *PSM* for one time period has limited validity since observation for individual stocks are highly correlated due to the common influence of market factors. In order to get more general results performance has to be calculated for a large number of periods. Except for the early study by Stäel von Holstein [1972], however, most studies about probabilistic stocks price forecasting apply a simple single period design. Results are mixed, either experts outperform novices (Önkal and Muradoglu 1995) or, more frequently, novices outperform experts (e.g. Stäel von Holstein 1972, Yates, McDaniel and Brown 1991). Results are in line with the efficient market hypotheses (see e.g. Fama 1970, 1991).

Table V reveals that there is virtually no difference in accuracy between domestic test group's judgments and foreign test group's judgment for each group of stocks.[16] Neither for German stocks nor for U.S. stocks do domestic investors show any significant superior performance. This suggest that differences in judgment are not due to actual superior information of domestic investors. Overall, participant's performance is rather weak. Comparing the accuracy of participants' probability judgments to the accuracy of a history-based forecast, i.e. a forecast identical to the historical relative frequencies (historical distribution), both test groups fall short of that benchmark. Comparing the accuracy of participants' probability judgments to the accuracy of a uniform forecast, i.e. a forecast identical to a uniform distribution, the same result applies. These results support the general finding that individual probability judgments about future stocks price changes are on average worse than simple benchmark estimates (see e.g. Yates, McDaniel and Brown 1991, Önkal and Muradoglu 1996).

## Stock Market Indices

Besides single stock data, we elicited people's judgments about the domestic and the foreign stock market index for which we also expect hypotheses 1, 2, and 3 to hold in tendency. However, we expect the effects to

**Table 5**. *Overall Accuracy of Probability Judgments for Single Stocks*

| | **German group** | **U.S. group** | **p-value**[a] | **Historical** | **Uniform** |
|---|---|---|---|---|---|
| PSM German stocks | *1.081* | *1.079* | *n.s.* | *0.710* | *0.834* |
| | *(0.35)* | *(0.28)* | | *(0.15)* | *(0.00)* |
| PSM U.S. stocks | *0.923* | *0.910* | *n.s.* | *0.790* | *0.834* |
| | *(0.34)* | *(0.38)* | | *(0.22)* | *(0.00)* |

*Note:* Mean overall accuracy of people's probability estimates and mean overall accuracy of simple benchmark forecasts according to a uniform distribution and according to historical relative frequencies of quarterly total stock returns 1985–1996. Overall accuracy is measured by *PSM* with 0 (perfect foresight) ≤ *PSM* ≤ 2. Entries are means, standard deviations (in parentheses) and significance levels. P-values refer to one sided Wilcoxon ranksum tests.

[a] Null: PSM foreign investors less or equal to PSM domestic investors.

**Table 6.** *Competence, Price and Probability Judgments for Stock Market Indices*

| | German test group | | | U.S. test group | | |
|---|---|---|---|---|---|---|
| a) | DAX | DOW | p-value[a] | DAX | DOW | p-value[a] |
| Competence | *2.9* | *2.2* | *<0.01* | *2.0* | *3.4* | *<0.01* |
| b) | DAX | DOW | p-value[b] | DAX | DOW | p-value[b] |
| Std (prob) $^{(-)}$ | *0.166* | *0.166* | *n.s.* | *0.150* | *0.152* | *<0.05* |
| Std (return) $^{(+)}$ | *4.26* | *4.26* | *n.s.* | *4.38* | *4.28* | *n.s.* |
| Std (point) $^{(+)}$ | *4.44* | *3.58* | *n.s.* | *6.97* | *5.97* | *n.s.* |
| c) | DAX | DOW | p-value[c] | DAX | DOW | p-value[c] |
| Mean (return) | *1.50* | *1.50* | *n.s.* | *0.00* | *0.75* | *n.s.* |
| Mean (point) | *1.26* | *1.24* | *n.s.* | *0.71* | *0.86* | *n.s.* |

*Note:* Mean competence judgments and median measures of dispersion and location based on people's price and probability estimates for various subsets of stocks derived from the stock's country of origin or people's competence ranking. $^{(+)}$ Higher number equals higher dispersion, $^{(-)}$ Lower number equals higher dispersion. Entries are means (a), medians (b, c) and significance levels. Std(return), Std(point), Mean(return), Mean(point) entries are in percent. P-values refer to one sided Wilcoxon rank sum tests.

[a]Null: Competence domestic index less or equal to competence foreign index. [b]Null: Dispersion foreign index less or equal to dispersion domestic index. [c]Null: Location domestic index less or equal to location foreign index.

be less pronounced. Correspondingly, our data reveals a rather weak picture as reported in Table VI. As expected both groups feel more competent for the domestic index than for the foreign index (German group: $C_{DAX} = 2.9$, $C_{DOW} = 2.2$, $p < 0.01$; U.S. group: $C_{DAX} = 2.0$, $C_{DOW} = 3.4$, $p < 0.01$). However, looking at price and probability judgments most differences are insignificant. Results based on the direct assessment of future index levels might be distorted by fact that the Dow Jones reference level was more than twice as large as the DAX reference level (6499 vs. 2797), so that a constant range of e.g. 100 points was proportionally larger for the DAX than for the Dow Jones. Accordingly, for both groups $Std(point)_{DOW}$ is judged to be lower than $Std(point)_{DAX}$. Further reasons for the rather indifferent picture might be the fact that probability judgments are elicited using a four interval partition $I^1,\ldots,I^4$ which probably does not allow people to differentiate enough between events. Besides, differences in perceived competence for the German group are rather weak on a relative high level (compared to single stock judgments) which might contribute to explain the observed pattern.

## Summary and Discussion

Various explanations have been proposed to rationalize the observed home bias in international equity portfolios but empirical evidence shows that hardly any effect is sufficiently large to explain the actual degree of the phenomenon. Asymmetric expectations could be a straightforward explanation of this puzzle. Our analysis shows that people on average feel more competent in judging domestic stocks than in judging foreign stocks. The perception of competence in turn seems to have a major influence on people's expectations expressed by the corresponding subjective probability distributions. In particular, our data confirms for both test groups the hypothesis that subjective probability distributions of stock returns are on average more dispersed for stocks associated with low competence levels than for stocks associated with high competence levels. Furthermore, our data reveals for both test groups that high competence stocks on average are judged more optimistically than low competence stocks. These results also hold comparing foreign stocks and domestic stocks. The fact that both test groups simultaneously exhibit these discrepancies support the assumption of asymmetries in expectations. This is confirmed by comparisons across test groups for identical sets of stocks. However, differences in competence have to be rather large to cause significant differences in expectations as suggested by the analysis of stock market index data.

After the fact, the question remains to what extent our results can be generalized to other groups of investors and other time periods. We are pretty positive about other groups of investors. As already discussed, Löffler and Weber [1997] have found similar effects in the responses of professionals and a number of studies, cited in more detail below, have found analogous results in quite a variety of areas. We are less sure about the effect of time period. Stock prices were generally increasing before and during the experiment, so future research has to show if our results also hold true in a downswing market.

In previous research it has been shown that competence has an important impact on people's preferences *beyond* what is captured by probabilities. Heath and Tversky [1991] demonstrate that people on average prefer to bet on their own judgment over an equiprobable chance event when they consider themselves competent about the event being judged. Otherwise they prefer betting on the chance event. We extent the analysis to investigate whether perceived competence also has an impact on the underlying beliefs expressed by probability judgments and find first evi-

dence for such a relation. Looking at related studies in other fields of research, particularly in psychology, we find further support for the observed patterns in people's judgments. They seem to be rather general traits in individual judgment.

A number of related studies reveal that in particular the observed difference in dispersion seems to be a rather stable effect. In various psychological studies about accuracy of expert judgments similar patterns can be found in the data. Yates, McDaniel and Brown [1991] and Önkal and Muradoglu [1996] report *Std*(*prob*) measures for semi expert judgments to be higher, i.e. more concentrated, than for novice judgments. Spence [1996] finds a confidence range measure for real estate valuation to be significantly tighter for experts judgments than for novice judgments. Our findings also correspond to the well documented overconfidence phenomenon in psychological literature. If people feel competent they generally overestimate the correctness of their answers which corresponds to tighter probability distributions. See Lichtenstein, Fischhoff and Phillips [1982] for a review and Odean [1999] for an application of overconfidence to the financial setting. Overall, the observed patterns in dispersion seem to be a rather common trait in individual judgment.

The observed asymmetry in location might be a more puzzling result. Generally, there seems to be no obvious explanation for the observed asymmetry in location. Comparing domestic investors and foreign investors judgments about identical stocks, a general positivity bias can hardly be explained by informational asymmetries since there seems to be no reason why on average their information should differ in that way. At most, asymmetries in information could explain an accentuation in people's judgment: less information leads to less extreme forecasts. However, there exist quite a number of studies which document a similar positivity effect in various situations. Reviewing the multiperiod cross country survey data in Shiller, Kon-Ya and Tsutsui [1996] they find that U.S. and Japanese institutional investors generally judged their respective domestic stock market index more optimistically than the respective foreign index. In related studies, e.g. Brown [1993] points out that analysts' earnings forecasts for stocks they observe are generally too positive, whether this is due to rational considerations or to psychological biases has not been identified yet. Statman [1999] finds that investors are more optimistic about home markets. Hausch and Ziemba [1990] report for cross track horserace bets that bets on particular horses are more optimistic on the horses home track than in other areas where the horse is less well known. Finally, in a follow up study to this paper, Panzer and Schiereck [2000] using the same procedure find a similar results for competence and dispersion. All this can be regarded as expression of a general "positivity bias" in probability judgment which is a rather well established phenomenon in psychological research. A related phenomenon is the "mere exposure effect" reported by Zajonc [1968] who shows that the more often people see a certain object the more extreme are their valuations of it.

The observed patterns in dispersion and in location may both contribute to explaining the obvious lack of foreign stock investments. According to French and Poterba [1991] the observed equity holdings could be explained by investors holding more optimistic expectations about domestic stocks than about foreign stocks. Correspondingly, assuming a mean-variance optimizing investor the observed equity holdings could also be explained by investors holding less dispersed expectations about domestic stocks than about foreign stocks. Levy and Livingston [1995] confirm that the inclusion of a superior asset, expressed either by lower expected standard deviation or by higher expected return, may provide a rationale for not diversifying. Additionally, Gehrig [1993] and Brennan and Cao [1997] show in a noisy rational expectation framework that asymmetric information expressed by more precise information about domestic stocks leads to a concentration on domestic stocks. Our data corresponds to the assumptions underlying these explanations: Expectations expressed by individual judgments are asymmetric in dispersion and in location. According to the models cited above the observed patterns in dispersion and in location lead to an underweighting of foreign stocks relative to domestic stocks.

The magnitude of the positivity bias expressed by our data roughly corresponds to the stock returns necessary to explain the observed portfolio holdings as reported in French and Poterba [1991]. French and Poterba show that observed U.S. portfolio holdings in the U.S. and in Germany imply that U.S. investors consider annual expected returns of U.S. stocks to be about 2% higher than German stock returns. Simply multiplying the difference in U.S. test group's quarterly *Mean*(*return*) between German stocks and U.S. stocks (Table 3c, right side) by four we get an annual difference in expectations of 2%, for *Mean*(*point*) we get an annual return difference of 4%. Our results may also apply on related phenomena in portfolio choice, such as the tendency for employees to overinvestment in their own employer's stock, the observed overinvestment in the regional operating telephone company serving an investor (relative to other regional operating telephone companies not serving him, see Huberman 1997) or a local equity preference in domestic portfolios (Coval and Moskowitz 1999).

In this paper we did not consider the impact of pure preference effects in the spirit of Heath and Tversky which are not captured by probabilities. These competence based preference effects may even further increase the preference for domestic stocks suggested by

our results (see e.g. Dow and Werlang 1992 for a theoretical treatment). Preference based competence effects may also explain why people do not invest in foreign indices though expectations do not differ significantly. Moreover, they might contribute to explaining why people do not hold short positions in foreign assets given the expectations described above. In general, first experimental evidence suggests that people are reluctant to hold short positions (see Weber, Keppe and Meyer-Delius 2000) the reason for which should be subject to further studies.

In this paper we regarded perceived competence as an individually given quantity. The determinants of perceived competence have not been considered. In order to better understand the underlying processes it might be a goal for future research to further analyze the perception of competence, e.g. to identify its components and their particular influence on probability judgments. It seems to be necessary to deliberately manipulate participants' information levels to find out more about the relation between information levels, perceived competence, and the shape of probability judgments in a controlled environment. Moreover, it has to be checked whether the observed relation between perceived competence and probability judgments can be replicated in other situations and with other groups of participants.

## Acknowledgments

Financial support from the Deutsche Forschungsgemeinschaft, through the Graduiertenkolleg "Allokation auf Finanz- und Gütermärkten" and the Sonderforschungsbereich 504 at the University of Mannheim, is gratefully acknowledged. We especially thank Elke Weber for conducting the study in the U.S. We are grateful to Shlomo Benartzi, Gur Huberman, Tilmann Betsch, Dirk Schiereck, participants of the 1997 CEPR workshop on economic theory at Gerzensee as well as seminar participants at the Fuqua School of Business, the Ohio State University, the University of Chicago, the University of Innsbruck, the University of Vienna and the Wharton School for valuable comments. Finally, we want to thank the members of the behavioral finance group at the University of Mannheim (www.behavioral-finance.de) for their support.

## Notes

1. The advantages of international diversification are known since Grubel [1968] and Levy and Sarnat [1970]. Evidence for a home bias in international equity portfolios is documented by French and Poterba [1991], Tesar and Werner [1995], and Cooper and Kaplanis [1994].
2. Cooper and Kaplanis [1994] and Glassman and Riddick [1996] both refer to the Adler and Dumas [1983] model with stochastic inflation. Deviations from purchasing power parity without inflation risk as modelled e.g. by Solnik [1974] could simply be hedged by domestic bonds only. However, even with stochastic inflation individual hedge portfolios will predominantly consist of domestic bonds rather than domestic stocks as Adler and Dumas [1983] point out.
3. Low [1992], Kang and Stulz [1995], and Gordon and Bovenberg [1996] also present models which derive a home bias from asymmetric information. For equilibrium models in a mean variance framework where investors hold different portfolios see the overview in Levy and Livingston [1995].
4. An exception is e.g. Shiller, Kon-Ya and Tsutsui [1996] who find evidence that expectations of U.S. and Japanese portfolio managers are asymmetric.
5. See Lichtenstein, Fischhoff and Phillips [1982], Keren [1991] or Yates [1990] for reviews of the overconfidence phenomenon. It is shown that the degree of overconfidence can be manipulated by various factors. Trafimov and Sniezek [1994] or Paese and Sniezek [1991] e.g. show that inducing the perception of expertise tend to increase overconfidence.
6. We are grateful to Elke Weber, who conducted the study at Ohio State University, for supporting this research.
7. In order not to distort results by elimination it is necessary to always eliminate a pair of related stocks from a persons set of stock judgements. Comparing high and low ranked stocks it is necessary to eliminate not just the faulty stock ranked *i* but also the related stock ranked *i'*=6-(*i*-1). Thus, a single error is sufficient for the elimination of the entire data sets of subject *s* about stock *i* and the related stock *i'*. For the German group 570 valid judgments (24 eliminations due to offences against the quantile order relation, 6 eliminations due to incomplete data and 6 other) and for the U.S. group 412 valid judgements (28 eliminations due to offences against the quantile order relation, 26 eliminations due to incomplete data and 2 other) remained. Moreover, if the explicit stock ranking contradicts the rank order implied by corresponding competence judgments (thus violating the task description) the latter was used instead.
8. $p^1_{s,i},\ldots,p^6_{s,i}$ add to one for 94.4% of all judgments. Those judgments not adding to one are normalized by dividing each number by the sum of $p^1_{s,i},\ldots,p^6_{s,i}$.
9. For simplicity we assigned the numbers –12.5%, –7.5%, –2.5%, 2.5%, 7.5%, 12.5% to $r^1,\ldots,r^6$ which basically correspond to the average return of each intervall. Assigning –12.5% and 12.5% to the end intervalls is a rather arbitrary, technical assumption which is softened by the circumstance that we are not interested in the absolute value of a measure but only in its relation to other judgments.
10. Keefer and Bodily [1983] test by numerical comparisons how good various approximation methods based on identical three point estimates approximate mean and standard deviation of various differently shaped probability distributions which are likely to occur in practice. We use the "Extended Swanson-Megill" approximation which performed best on average for the point estimates given. For more detail see Keefer and Bodily [1983]. Additionally, we calculated from $X^{0.1}$ and $X^{0.9}$ the relative confidence range $Range(point) = (X^{0.9} - X^{0.1})/X^{0.9}$ which directly describes the width of the distribution. Results are not reported since this measure provides very similar results to *Std*(*point*) in direction and in significance.
11. All p-values are from Wilcoxon rank sum tests. We cannot apply the parametric t-test since observations do not come from a normal distribution. All measures of dispersion have a lower bound of 0, *Std*(*prob*) and *Std*(*return*) additionally have upper bounds. Moreover, the hypotheses that observations are from a normal distribution is rejected by a Komolgorov-Smirnov test. Besides all, we calculated t-statistics for comparison. For *Std*(*prob*) and *Std*(*return*) significance levels are generally confirmed, for *Std*(*point*) a number of significance levels deteriorate due to higher standard deviations.

12. Splitting up the full sample and comparing results across version it can be seen that for both test groups measures of dispersion are rather similar for each of the four versions. German group: For each version measures of dispersion yield results in the same direction as indicated by Table II. Though significance levels are generally weaker, particularly due to lower numbers of observations per version, about two thirds of all results in a,b,c are still significant at the 5% level. Significance levels across version are comparabel. U.S. group: For each version measures of dispersion based on probabilities $p^1,\ldots,p^6$ yield the same result in direction as indicated in Table II. *Std*(*point*) behaves rather irregularly across versions. Significance levels across version are comparabel. However, the majority of results is insignificant. Overall, results do not seem to be driven by one particular version.
13. Additionally, we computed from $X^{0.5}$, the measure $Median(point) = (X^{0.5} + Div)/X_0 - 1$,where $X_0$ is the price of the respective stock at the beginning of the study. Results are not reported since this measure provides similar results to *Mean*(*point*) in direction and in significance.
14. All p-values are from Wilcoxon rank sum tests. We also calculated parametric t-statistics which confirm for *Mean*(*return*) the significance levels obtained by Wilcoxon rank sum tests. For *Mean*(*point*) some significance levels deteriorate but no originally significant value falls below 10%.
15. Splitting up the full sample and comparing results across versions, it can be seen that for both test groups measures of location are rather similar for each version: All results are in the same direction as indicated by Table III. Significance levels are weaker, however, particularly due to lower numbers of observations per version. For the German group about two thirds of all results in a,b,c are still significant at the 5% level, for the U.S. group about one half of all results. Overall, results do not seem to be driven by one particular version.
16. The difference in accuracy between German stocks and U.S. stocks can be explained by the fact that German stocks performed extraordinarily well in the time period considered. Nine of twelve stocks increased by more than 10%, two between 5% and 10 %, and one between 0% and 5%. The twelve U.S. stocks, on the other hand, revealed a more differentiated picture. Three of twelve stocks increased by more than 10%, two between 5% and 10%, three between 0% and 5%, two decreased between 0% and 5%, and two decreased by more than 10%.

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## Appendix: Stock Price Changes of American and German Stocks

In this questionnaire [Table A1] we would like to ask you to judge future stock price changes of several American and German stocks and to judge your competence concerning each stock price judgment. Please answer the following questions completely! The questions always refer to the per share stock price in the respective *local currency*: German stocks in Deutsche Mark (DM), U.S. stocks in $ (1 $ ≈ 1.50 DM). U.S. stocks are traded on the New York Stock Exchange, German stocks on the Frankfurt Stock Exchange.

**Table A1.** *Questionnaire*

- Imagine you should estimate today the price of the following stocks and stock indizes on March 3, 1997. How *competent* do you feel in estimating the price of each stock and stock index? Please mark on a scale from 0 (= not competent at all) to 6 (= very competent):

| | | Closing price on 11/27/1996 | Competence |
|---|---|---|---|
| *Wal-Mart Stores* | (USA, Retail) | 25 3/8 $ | 0- - - -1- - - -2- - - -3- - - -4- - - -5- - - -6 |
| *Karstadt* | (Germany, Retail) | 531.00 DM | 0- - - -1- - - -2- - - -3- - - -4- - - -5- - - -6 |
| *Caterpillar* | (USA, Ind. Equip.) | 79 5/8 $ | 0- - - -1- - - -2- - - -3- - - -4- - - -5- - - -6 |
| *Mannesmann* | (Germany, Ind. Equip.) | 633.00 DM | 0- - - -1- - - -2- - - -3- - - -4- - - -5- - - -6 |
| *Du Pont* | (USA, Chemicals) | 93 3/4 $ | 0- - - -1- - - -2- - - -3- - - -4- - - -5- - - -6 |
| *Hoechst* | (Germany, Chemicals) | 65.35 DM | 0- - - -1- - - -2- - - -3- - - -4- - - -5- - - -6 |
| *U.S. stock market:* | DOW JONES | 6499.34 | 0- - - -1- - - -2- - - -3- - - -4- - - -5- - - -6 |
| *German stock market:* | DAX | 2797.03 | 0- - - -1- - - -2- - - -3- - - -4- - - -5- - - -6 |

Please *rank* the six stocks from *A* to *F* according to your competence judgment indicated above. Rank *A* should be assigned to the stock with the highest judged competence, rank *F* to the stock with the lowest judged competence. In case of identical competence judgments please decide which stock you would rather assign to the better rank.

Rank A:_____ Rank B: _____ Rank C: _____ Rank D:_____ Rank E: _____ Rank F: _____

- How do you judge the *probabilities* (in percent) that the stock price change by 03/03/1997 (relative to the current stock price given above) will be within the specified ranges? Please keep in mind that the total of judged probabilities for each stock should be equal to 100%.

By 03/03/1997, the stock price will…

| Stock | ***decrease* by more than 10%** | ***decrease* by 10% to 5%** | ***decrease* by 5% to 0%** | ***increase* by 0% to 5%** | ***increase* by 5% to 10%** | ***increase* by more than 10%** | **Total** |
|---|---|---|---|---|---|---|---|
| *Wal-Mart Stores* | \|_____\| | \|_____\| | \|_____\| | \|_____\| | \|_____\| | \|_____\| | =100% |
| *Karstadt* | \|_____\| | \|_____\| | \|_____\| | \|_____\| | \|_____\| | \|_____\| | =100% |
| *Caterpillar* | \|_____\| | \|_____\| | \|_____\| | \|_____\| | \|_____\| | \|_____\| | =100% |
| *Mannesmann* | \|_____\| | \|_____\| | \|_____\| | \|_____\| | \|_____\| | \|_____\| | =100% |
| *Du Pont* | \|_____\| | \|_____\| | \|_____\| | \|_____\| | \|_____\| | \|_____\| | =100% |
| *Hoechst* | \|_____\| | \|_____\| | \|_____\| | \|_____\| | \|_____\| | \|_____\| | =100% |

- Now we would like to ask you to assess future *stock prices* in local currency!

| Stock | **What is your *forecast* for the stock price on 03/03/1997, i.e. for which value is it equally likely that the stock price on 03/03/1997 will be above respectively below this value?** | **Which value do you expect the stock price on 03/03/1997 with high probability (90%) not to *fall short* of?** | **Which value do you expect the stock price on 03/03/1997 with high probability (90%) not to *exceed*?** |
|---|---|---|---|
| *Wal-Mart Stores* | \|_____\| $ | \|_____\| $ | \|_____\| $ |
| *Karstadt* | \|_____\| DM | \|_____\| DM | \|_____\| DM |
| *Caterpillar* | \|_____\| $ | \|_____\| $ | \|_____\| $ |
| *Mannesmann* | \|_____\| DM | \|_____\| DM | \|_____\| DM |
| *Du Pont* | \|_____\| $ | \|_____\| $ | \|_____\| $ |
| *Hoechst* | \|_____\| DM | \|_____\| DM | \|_____\| DM |

- If dividend payments occur during the considered time period, the stock price will usually decrease after the dividend due date. To evaluate your forecasts correctly: Do your answers explicitly include a stock price decrease due to expected dividend payments by 03/03/1997?

| | | | |
|---|---|---|---|
| *Wal-Mart Stores*: | No [ ] Yes, to the amount of [ ] $ | *Karstadt*: | No [ ] Yes, to the amount of [ ] DM |
| *Caterpillar*: | No [ ] Yes, to the amount of [ ] $ | *Mannesmann*: | No [ ] Yes, to the amount of [ ] DM |
| *Du Pont*: | No [ ] Yes, to the amount of [ ] $ | *Hoechst*: | No [ ] Yes, to the amount of [ ] DM |

- How do you judge the *probabilities* (in percent) that the index level change by 03/03/1997 (relative to the current index level given above) will be within the specified ranges? Please keep in mind that the total of judged probabilities for each index should be equal to 100%.

By 03/03/1997, the index level will…

| Index | ***decrease* by more than 5%** | ***decrease* by 5% to 0%** | ***increase* by 0% to 5%** | ***increase* by more than 5%** | **Total** |
|---|---|---|---|---|---|
| *DOW JONES* | \|_____\| | \|_____\| | \|_____\| | \|_____\| | =100% |
| *DAX* | \|_____\| | \|_____\| | \|_____\| | \|_____\| | =100% |

- Now we would like to ask you to assess future *index levels!*

| Index | **What is your *forecast* for the index level on 03/03/1997, i.e. for which value is it equally likely that the index level on 03/03/1997 will be above respectively below this value?** | **Which value do you expect the index level on 03/03/1997 with high probability (90%) not to *fall short* of?** | **Which value do you expect the index level on 03/03/1997 with high probability (90%) not to *exceed*?** |
|---|---|---|---|
| *DOW JONES* | \|_____\| | \|_____\| | \|_____\| |
| *DAX* | \|_____\| | \|_____\| | \|_____\| |

- Finally some questions concerning your personal experience with stocks:

| | |
|---|---|
| Are you a graduate or an undergraduate student? | Graduate Undergraduate |
| Your major: | _____ |
| Have you owned stocks or shares of equity funds at any time during the last two years? | Yes No |
| If you have owned stocks or shares of equity funds, has your portfolio contained foreign stocks or shares of funds investing in foreign stocks? | Yes No |
| If you are interested in stocks, for *how long* have you already been following stock prices? | For _____ years |