THE EQUITY HOME BIAS: CONTRASTING AN INSTITUTIONAL WITH A BEHAVIORAL EXPLANATION*

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Abstract

An empirically well-established finding is that equity portfolios are concentrated in the domestic equity market of the investor. Previous theoretical and empirical analyses have mainly focused on institutional explanations and largely neglected individual behavior. In this study we report the results of an experiment in which we contrast institutional with behavioral explanations by comparing asymmetric information to social identity. Our results show that social forces, triggered by group affiliation, drive underdiversified and domestically biased portfolio allocations. Moreover, social identity explains the observed behavior equally well as asymmetric information. We also find that individuals are spuriously more optimistic toward the performance of domestic firms.

Keywords: investment decisions; behavioral finance; experimental economics; international economics; behavioral decision making

JEL-Classification: C91, F30, G15

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I. Introduction

One of the most striking empirical results in international finance is that investors hold too little of their financial portfolios in foreign equity despite large potential gains from international diversification. This discrepancy between actual and optimal international equity portfolios constitutes the equity home bias.

Empirical indications for potential gains from international diversification are twofold: First, correlations on returns on equity portfolios between countries are far from being perfectly positive. According to an empirical analysis by Lewis [1999] on monthly data from January 1970 to December 1996, the median correlation on returns between the G-7 countries (US, Canada, France, Germany, Italy, Japan, UK) is only 0.38.[1] Second, the proportion of portfolios held in domestic equity exceeds the domestic market capitalization as a proportion of the world equity market capitalization. Cooper and Kaplanis [1994] report for the year 1987 that US investors hold 98% of their equity portfolios in domestic equity against a world market capitalization of US equity of 36.4%. For some countries this disproportion is even more pronounced, e.g. 75.4% against 3.2% for Germany and 94.2% against 1.1% for Spain.

Previous attempts to resolve the equity home puzzle primarily stressed institutional explanations and largely neglected individual investor behavior.[2] Issues falling in the first category, for instance hedging possibilities against domestic risk, barriers to capital flow, and information asymmetries, have been discussed as potential explanations for the equity home bias [see Lewis 1999; Stulz 1995, for surveys]. Dissatisfaction with institutional explanations has led to also consider behavioral explanations, e.g. familiarity [Huberman 2001], optimism toward the domestic equity market [French and Poterba 1991], and asymmetric expectations expressed by individual probability judgments [Kilka and Weber 2000].

In this paper we propose another behavioral explanation that might contribute to explaining the equity home bias, namely social identity. The theory of social identity has been extensively studied in the psychological literature, especially emphasizing the development of group identity and intergroup differentiation, and has also been successfully applied to large group phenomena, such as ethnicity and nationality. The concept of social identity is also evident in daily economic life. Many manufacturers, for instance, advertise their goods by stressing the fact

1 This value is computed from Table 1.

2 The distinction between institutional and behavioral explanations was first suggested by French and Poterba [1991].

that they are produced domestically,[3] and internet companies like *OneShare.Com* explicitly appeal to customers to buy US shares in order to support the domestic economy.

Drawing upon experimental methods, we investigate whether social identity, expressed by group affiliation, can account for underdiversified and biased portfolios, resulting in phenomena like the equity home bias. As a competing hypothesis, we investigate the impact of asymmetric information on investment behavior in a second treatment. More specifically, in the experiment pairs of subjects are randomly assigned to run companies, whereby three companies are a subset of one of two distinct production groups. Subjects can invest their endowment in shares of all six companies. Our results show "domestically" biased portfolio allocations in both treatments. Moreover, social identity explains the observed behavior equally well as asymmetric information, providing empirical evidence that, by solely focusing on institutional explanations, one captures the equity home bias insufficiently. Social forces, like the identification with one's national companies, might play an equally important role. More specifically, we also find that individuals tend to be more optimistic toward domestic production.

The paper proceeds with a discussion of institutional and behavioral explanations of the equity home bias. In section 2, our model and our theoretical benchmarks are introduced. Section 3 describes the experimental design and the procedure. Section 4 covers our results, and, finally, section 5 discusses our main findings.

I.1 Institutional explanations for the equity home bias

The existence of the equity home bias may be due to hedging possibilities against domestic risk, barriers to capital flow, and information asymmetries. These explanations, which highlight the importance of investment costs, require extensions to the standard CAPM, however, without explicitly considering individual investment behavior.

Hedging possibilities arise when the purchasing power parity, implying equal inflation rates across countries, does not hold. The models of Adler and Dumas [1983] and Stulz [1981] show that differences in inflation rates across countries create a demand for assets to hedge domestic inflation. However, in an empirical investigation Cooper and Kaplanis [1994] show that very low levels of risk aversion would be necessary to account for inflation hedging as a plausible explanation for actual equity holdings. Their results even indicate that hedge motives could

3 Referring to domestically produced goods, however, may also be an implicit quality signal.

sometimes lead to investment behavior in the opposite direction to the equity home bias.

A second source for hedging possibilities against country-specific risk is non-traded wealth, such as human capital. In the models of Eldor et al. [1988] and Tesar [1993], price uncertainty of non-traded goods creates a motive to invest in domestic equities. However, Baxter and Jermann [1997] show that, for instance, human capital returns are highly correlated with domestic returns but not with foreign stock returns. Hedging possibilities thus arise by short selling domestic in favor of foreign equity.

A third hedging possibility emanates from internationally operating companies. Their returns already contain business in foreign markets, allowing investors to benefit from international diversification. However, since the movement of stock returns of multinational companies is closely related to their respective national markets, investments in those companies do not provide better diversification than the domestic market [e.g., Heston and Roewenhorst 1994; Jacquillat and Solnik 1978].

Another stream of research stresses the importance of barriers to international capital flow, that is, transaction costs, taxes, market frictions, restrictions on capital holdings by foreigners, in explaining the equity home bias [e.g., Black 1974; Bonser-Neal et al. 1990; Davis 1991; Stulz 1981]. In an empirical study, Tesar and Werner [1995] show that high transaction rates of foreign equity contradict the explanation of the home bias in terms of transaction costs. Also, if the transaction cost argument holds, then traders should invest in the most liquid and not necessarily in the domestic market [French and Poterba 1991]. Moreover, in recent years capital markets have been liberalized substantially, predicting to alleviate the equity home bias. Empirical evidence, however, indicates that international underdiversification prevails [Lewis 1999].

Asymmetric information with respect to domestic and foreign equity constitutes a further possible explanation for the equity home bias. In the theoretical models on asymmetric information, domestic investors have superior information about payoffs on the domestic market [Brennan and Cao 1997; Gehrig 1993; Kang and Stulz 1997; Low 1993] leading to a higher demand for domestic equity. Asymmetric information is also considered to be the driving force of observed investments in firms which are geographically proximate to the investor. Coval and Moskowitz [1999, 2001], for instance, show that US investment managers exhibit a strong preference for locally headquartered companies. While asymmetric infor-

mation may explain a considerable share of the equity home bias, for most of the countries it would require an unrealistically large reduction of domestic risk [Jeske 2001]. Thus, it is not likely that asymmetric information can be a unifying explanation for the equity home bias.

Institutional explanations for the equity home bias primarily stress cost-benefit analyses of international investments; the costs of international diversification may outweigh the gains. However, domestically biased portfolios are associated with losses up to several hundred basis points compared to the optimal portfolios [Jeske 2001]. Can the costs really be that high to prevent intermediaries to exploit the benefits from international diversification? It rather seems that the sole consideration of institutional explanations is insufficient, leading several authors to focus on behavioral explanations based on investor choice instead.

I.2 Behavioral explanations for the equity home bias

Behavioral approaches to the equity home bias draw upon psychological aspects of individual behavior. In the literature so far, familiarity of companies, overly optimistic performance predictions of domestic firms, and subjective competence in the home market have been discussed as possible explanations for the equity home bias from a behavioral perspective. In this paper we propose another behavioral approach to account for biased domestic investments, namely social identity.

An empirical analysis of the geographic distribution of shareholders of the Regional Bell Operating Companies suggests that individuals tend to invest in the familiar by choosing companies on which they have superior information or at least think they have [Huberman 2001]. Investors seem to have static portfolios and rather buy and hold familiar stocks than sell them. These findings are not in line with the asymmetric information approach, which predicts to exploit informational advantages by an active trading strategy. Evidence for the familiarity hypothesis is also provided by Barber and Odean [2002], who show that especially individual investors display attention-based buying behavior.

A special case of investing in the familiar is investment in own company stock. Empirical evidence indicates that for some saving plans, e.g. in the case of Coca-Cola, employees allocate as much as three-quarters of their discretionary contributions to own company shares [Benartzi 2001]. Excessive investment in own stock is contradictory to the diversification paradigm of standard finance theory, and involves the additional risk of not only losing retirement savings but also jobs if

the company runs bankrupt. Based on survey evidence, Benartzi [2001] shows that high familiarity with one's employing firm aggravates the extrapolation of past and future performance of company stock, whereby he asserts that this extrapolation constitutes the driving force of excessive own company investment. The author also outlines that familiarity with own company stock is positively correlated with the perceived safety of it. Generally, extrapolating from past to future performances and underestimating company risk portend overoptimism and overconfidence of investors.

A further potential behavioral explanation for the equity home bias is proposed by French and Poterba [1991], who conjecture that investors may be relatively more optimistic about their home markets, resulting in domestically biased investments. Support for this hypothesis is provided by Shiller et al. [1996], who show that Japanese and US investors are relatively more optimistic about their domestic market based on forecasts of stock market indices. Also, the results of Strong and Xu [forthcoming], who analyze the Merrill Lynch monthly Fund Manager Survey, lend support to the relative optimism hypothesis with respect to Japanese, Continental European, UK, and US fund managers. Generally, domestic investors seem to be more optimistic about the home market than foreign investors are.

In addition to the familiarity and the relative optimism hypotheses, Kilka and Weber [2000] argue that domestically biased investments may be due to subjective competence and asymmetric expectations, expressed by probability judgments, toward the performance of domestic stocks. In an experimental study with German and US students, the authors show that for both groups the subjective probability distribution of stock returns is less dispersed and more optimistic for domestic stocks. Particularly, German (US) subjects reveal higher dispersion for US (German) than for German (US) stocks, and within each country, higher dispersion for companies they feel less competent about. Also, individuals prefer to bet in a context where they feel competent rather than uninformed, leading them to "forego the advantage of diversification and concentrate on a small number of companies with which they are presumably familiar" [Heath and Tversky 1991, p. 26].

While familiarity with domestic companies, overoptimism, and subjective competence are plausible explanations of the equity home bias, they might merely be the concomitant of a more fundamental underlying social process, namely social identity. The psychological theory of social identity by Tajfel and Turner [1979] defines it as group membership based on self-categorization, social comparison, and the construction of a shared self-definition [for an introduction to social

identity theory see, e.g., Hogg and Vaughan 2002; Smith and Mackie 2000]. Self-categorization refers to the process of seeing oneself as a member of a social group, social comparison serves as a means to track similarities and differences between oneself and a social group, and an established shared self-definition fosters group identity and intergroup differentiation.

Every individual is a member of different groups, for instance with respect to ethnicity and religion, political affiliation, family and professional affiliation, etc. [Smith 1991]. One of the most salient affiliations is nationality: "Of all of the categories relevant for self and other definition, the category of 'the nation' is perhaps the most politically significant" [Hopkins and Murdoch 1999, p. 321]. Indeed, social identity theory has been proposed as an eligible concept to understand national phenomena [Salazar 1998] and has also been successfully applied to explain various ethnical and national frictions, such as the Northern Ireland conflict [Cairns 1982; Gallagher 1989], Czech identity in post-communism [Holy 1996], and German social identity after reunification [Mummendey et al. 1996].

Social identity theory is usually studied in the laboratory by drawing upon small group behavior. It is argued that many basic behavioral principles which occur in small groups are likely to also play an important role in large group phenomena, such as ethnical and national identification. Empirical evidence on ethnical discrimination in laboratory settings, for instance, shows that individuals bring their prejudices to the lab, without being aware of them [e.g., Fershtman and Gneezy 2001]. Behavior in the trust game with subjects from two different ethnical affiliations, for instance Israelis of Ashkenazic and of Sephardic origin, reveals a systematic mistrust of males of the former ethnicity toward males of the latter ethnicity, as inferred by the co-player's name.

Previous experimental evidence indicates that even minimal group induction, i.e., forming groups according to trivial criteria, leads to reliable group formation and group differentiation. Rabbie and Horwitz [1969] report the results of a study in which subjects are randomly assigned to two distinct groups, whereby a coin flip determines which group receives a gift. This manipulation is already sufficient to create an ingroup-outgroup bias, referring to the fact that subjects perceive the members of the other group as less familiar, less friendly, and less desirable as associates than members of their own group.

Similar results are reported for a variety of intergroup situations, e.g., group competition [Rabbie and Wilkens 1971], group achievement [Blake and Mouton 1961], explicit similarity or distinctiveness between in- and outgroup [Dustin and

Davis 1970], and for different evaluation criteria, e.g., personality trait ratings [Brewer and Silver 1978], group and process ratings [Janssens and Nuttin 1976], and distribution decisions [Billig and Tajfel 1973].

One might argue that despite the importance of social identity theory in many different behavioral domains, this might be less likely to play a major role in financial decision making when investors' actual funds are at stake rather than their opinions. Evidence on wishful thinking in betting markets, for instance, undermines this assertion. Babad and Katz [1991] study betting behavior on soccer teams and demonstrate that individuals act against their financial interest by betting on their preferred team. However, they should rather diversify, i.e., bet on the non-preferred team: If individuals gain utility from seeing their preferred team winning, the monetary losses of betting on the competing team might be offset. On the other hand, if the preferred team loses, they are monetarily compensated by their betting profits. Preference for a certain team might reflect one's identification with it by constituting group affiliation. Biased retirement saving plans provide another example why social identity is also important in financial decision making. Identification with one's company might be one of the driving forces why individuals excessively invest in own company stock, disregarding the benefits from diversification. Social identity theory thus does not seem to be limited to nonfinancial decision situations, and may offer an additional explanation for the equity home bias.

In this study we contrast an institutional with a behavioral explanation of the equity home bias. More specifically, we investigate the home bias by either providing asymmetric information or by inducing social identity in the context of a closed market setting. The basic market model is introduced in the next section.

II. The market model

We consider a two-country model. In each country, there are three independent firms j. Each firm j consists of two workers i. Workers choose their effort level e_{ij} which is either low $\underline{e}$ or high $\overline{e}$. Effort levels are associated with costs c, whereby $c(\underline{e}) < c(\overline{e})$. Workers earn a fixed wage $\overline{w}$ independently of their effort choice.

The firms' operating profits π_j depend on the sum of the workers' efforts and the wages paid:

$$\pi_j = a_j \sum_i e_{ij} - 2\overline{w}. \tag{1}$$

We assume that the current market situation enters the firm's profit function via $a_j \in \{2/3, 3, 4\,2/3, 5, 5\,1/3, 7\}$, whereby each firm faces a unique market situation ($a_j \neq a_k \; \forall \; j \neq k$). The values of a_j are chosen such that the firms' intercorrelations are negative ($r = -.20$), providing obvious incentives for diversification across all firms, favoring neither domestic nor foreign companies.[4]

Firms issue shares that can be acquired by workers at a fixed price $\overline{p}$, which is equal for all firms' shares. Subsequently, we refer to workers i as investors i. The intuition for equal prices is simply that we assume that each firm makes an initial public offer to the market and that no (or only unreliable) prior market research on predicted firms' operating profits has been undertaken. Investors cannot identify firms according to their assigned market parameter a_j.

Firms' revenues m_j from issuing shares are represented by

$$m_j = \overline{p} \sum_i k_{ij} \tag{2}$$

whereby k_{ij} denotes the number of shares of firm j held by investor i.

The firms of one country compete with the firms of the other country with respect to operating profits. The country with the higher total profits earns a bonus b at the expense of the country with the lower total profits.[5] Each firm's

4 Since the probability that a certain a_j is realized is one-sixth the intercorrelations can be computed according to

$$Cor(a_j, a_k) = \frac{Cov(a_j,a_k)}{\sqrt{Var(a_j)Var(a_k)}} = \frac{Cov(a_j,a_k)}{Var(a_j)}$$

whereby

$$\begin{aligned} Cov(a_j, a_k) &= E[(a_j - \overline{a})(a_k - \overline{a})] = \\ &= E(a_j a_k) - \overline{a}E(a_j + a_k) + \overline{a}^2 = \\ &= \tfrac{1}{30}\textstyle\sum_{j\neq k} a_j a_k - \tfrac{1}{30}\overline{a}\sum_{j\neq k}(a_j + a_k) + \overline{a}^2 \end{aligned}$$

and $\overline{a}$ denotes the expected value of the market parameter.

5 Since the psychological literature indicates that competition enhances social identity, we introduce intercountry competition by offering a bonus. In order to keep the two experimental treatments,

wealth v_j is divided among its investors in the form of dividends d_j.

$$(3) \qquad v_j = \pi_j + m_j \begin{cases} \left.\begin{array}{ll} +1/3b & \forall\ j = 1,\ 2,\ 3 \\ -1/3b & \forall\ j = 4,\ 5,\ 6 \end{array}\right\} \text{if } \sum_{j=1}^{3} \pi_j > \sum_{j=4}^{6} \pi_j \\ \left.\begin{array}{ll} -1/3b & \forall\ j = 1,\ 2,\ 3 \\ +1/3b & \forall\ j = 4,\ 5,\ 6 \end{array}\right\} \text{if } \sum_{j=1}^{3} \pi_j < \sum_{j=4}^{6} \pi_j \\ +1/6b \quad \forall\ j = 1, \ldots, 6 \quad \text{if } \sum_{j=1}^{3} \pi_j = \sum_{j=4}^{6} \pi_j. \end{cases}$$

Note that $j \in \{1, 2, 3\}$ denotes the firms of one's own country and $j \in \{4, 5, 6\}$ denotes the firms of the other country. We assume that firms pay out dividends to all their investors in proportion to the total number of shares bought:

$$(4) \qquad d_j = \frac{v_j}{\sum_i k_{ij}}.$$

The payoff function of the investors y_i is therefore expressed by

$$(5) \qquad y_i = \overline{w} - c(e_i) - \overline{p} \sum_j k_{ij} + \sum_j k_{ij} d_j.$$

The parameters of the market model, which will also be used in the experiment, are displayed in Table I. All monetary values are quoted in Experimental Currency Units (ECU). The exchange rate for ECU is 10:1, that is, 10 ECU equal €1.

Due to the complexity of the model, we abstain from analyzing it game theoretically. Instead, we focus on intuitive and plausible theoretical benchmarks, based on the assumption that investors are characterized by μ-σ preferences and maximize their profits.

Particularly, the model's implications are twofold: the first concerns the effort and the second the investment decisions. Workers might choose their effort strategically with respect to intended investment in their own company. However, successful investments require full diversification across all companies, since

asymmetric information and social identity, as similar as possible, intercountry competition is introduced in both treatments. The monetary impact of the bonus is negligible, however. Winning firms obtain a fixed bonus of 10, which is about 3.24% of the average firm profit.

Table I: Parameter table

Parameters	Values	Description
$\underline{e}$	15	Low effort
$\overline{e}$	60	High effort
$c(\underline{e})$	5	Low effort cost
$c(\overline{e})$	20	High effort cost
$\overline{w}$	36	Fixed wage
$\overline{p}$	1	Fixed share price
b	10	Competition bonus

uncertainty about the random assignment of the market parameter a_j crucially determines the optimal portfolio allocation.

PROPOSITION 1 *Individual effort choices e_i are contingent on own company investment k_{ij}, the market situation a_j, and the total asset emission of one's company $\sum_i k_{ij}$:*

$$e_i = \begin{cases} \overline{e} & \text{if} \quad \dfrac{k_{ij}}{\sum\limits_i k_{ij}} > \dfrac{1}{3a_j} \\ \underline{e} & \text{if} \quad \dfrac{k_{ij}}{\sum\limits_i k_{ij}} < \dfrac{1}{3a_j}. \end{cases} \tag{6}$$

Proof. See Appendix A □.

Optimal effort choice depends on the ratio of own company investment to the total number of emitted assets by this specific company, and its market parameter. In case the investor does not plan to invest in the own company, but others do, she would never pick $\overline{e}$.

Assuming a non-negative own company investment ($k_{ij} > 0$), the left-hand side of the inequality of condition 6 cannot exceed a value of 1, since the numerator is always smaller than, or equal to, the denominator. The right-hand side of the above inequality may only take one of six discrete values; $1/3a_j \in \{1/2, 1/9, 1/14, 1/15, 1/16, 1/21\}$. Thus, under the assumption of a non-negative own company investment, the optimal effort choice cannot be derived independently of the realization of the market parameter and the simultaneous investments of the other market participants.

PROPOSITION 2 *Optimal investment, expressed by the vector* $(X_1^\star, \ldots, X_6^\star)$*, requires to evenly distribute one's asset holdings across all six firms,* $X_j^\star = 1/6 \; \forall j$.

Proof. See Appendix A □.

Usually the optimal portfolio allocation can be determined by solving a quadratic programming problem, whereby the underlying objective function comprises the expected value and the variance of the optimal portfolio as well as the risk-free rate of return, and the constraint is characterized by not allowing short sales. This standard procedure yields optimal asset allocations for each company, given a specific market situation. However, in our model investors lack important information. They cannot infer which of the six firms is assigned which specific market situation parameter. The only information available to them is the latter's probability distribution. If investors could identify specific firms, they would diversify their investments according to the optimal portfolio allocation. Since this identification possibility is not provided, investors have to diversify according to their expectations. Each firm is equally likely to be assigned one of the six market situation values; therefore investors should optimally allocate their investments evenly across all firms.

III. EXPERIMENTAL DESIGN AND PROCEDURE

One hundred forty-four undergraduate subjects from various disciplines participated in 12 markets, each consisting of 12 subjects. We therefore ran six independent observations per treatment. The experiment was conducted at the Max Planck Research Laboratory in Jena, using z-Tree [Fischbacher 1999]. The participants' earnings were contingent on their decisions and amounted, on average, to €8.80 with a standard deviation of €3.78. Seventy-seven females and 67 males, aged 18 to 40 ($M = 22.11, SD = 2.84$), participated in the study.

The aim of the present study is to investigate the existence of the equity home bias in a simple market environment, independently for the case of providing asymmetric information and inducing social identity. Moreover, we try to establish in which of the two scenarios the equity home bias is more severe. Finally, we study whether investors exhibit more optimism toward domestic production.

More specifically, we stipulate two treatments, asymmetric information and social identity. In the former, subjects are informed about the existence of six different firms, referred to as *Firm 1* to *Firm 6*. We assign these six firms to

two groups. Subjects are, however, not explicitly informed about this assignment and their actual group affiliation. Instead, subjects receive information about the aggregate profits of three firms (of their group) after realization of the random parameter a_j.[6] Across the four periods, rematching of subjects into new firms takes place within the subjects' own group.

Like in the first treatment subjects in the social identity treatment are randomly assigned to one of two groups. We induce social identity by informing subjects about their group affiliation and by labeling the two groups as combine *Alpha* and *Omega*. In each combine there are three different firms, referred to as *Alpha 1* to *Alpha 3* and *Omega 1* to *Omega 3*, respectively. Thus, like in the asymmetric information treatment there is a total of six firms. Subjects are explicitly informed about their group (combine) and firm affiliation, but obtain no additional information, e.g. on profits. Across the four periods, rematching of subjects is limited to one's group, that is subjects maintain their group affiliation, but are assigned to firms anew in each period.

In both experimental treatments, our market model suggests the same theoretical benchmark of equal diversification among groups. Even the provision of aggregate information of group profits does not constitute an informational advantage. From group profits no clear inferences about individual firm profits or the superiority of one group over the other can be derived. Thus, neither the enforcement of social identity nor the provision of asymmetric information are relevant for the theoretical decision framework.

We will now explain the experimental procedure in more detail. First, subjects are randomly assigned to their firms, whereby each firm consists of two members and three firms constitute one group (in the social identity treatment groups are referred to as combines).[7] Subjects then independently either choose high or low effort, whereby joint-effort and the random parameter a determine firms' profits. Subjects do not obtain information about their co-workers' effort choices. Afterwards, subjects are asked to predict the firms' ranking according to the profits. For each rank correctly guessed subjects obtain an extra 10 ECU. This additional income is added to the profit at the end of the period.

6 Due to the parameter choice, it was highly unlikely that subjects would have been able to infer the effort choices of the workers and the random parameter a from the provided aggregate profit information. This and the fact that no intergroup comparisons are possible renders the provided information insufficient.

7 Information about group affiliation was provided in a neutral manner. The instructions are to be found in Appendix B.

Only in the asymmetric information treatment are subjects then informed about the aggregate profits of three firms (of their group). Subjects in both treatments can invest their wages to buy shares of the firms. The residual wage, which is not invested, earns zero interest. Share prices are equal for all six firms. Finally, subjects are informed about the dividends they earn, separately for all six firms. At the end of the period, the earnings are displayed, split up into the different income sources. This procedure is repeated four times. However, only one of the periods is randomly selected to determine the final individual payoff.

IV. Results

This section proceeds with some descriptive findings, followed by an analysis of investment behavior in the two treatments of asymmetric information and social identity. We then investigate own company investment and optimism concerning own group profits. In the following we refer to investments in one's own group as domestic and home investments, as opposed to investments outside one's group, which are referred to as foreign investments.

Twenty subjects constantly choose low effort throughout the four periods and 50 subjects persistently pick the high effort choice. The remaining 74 subjects change their effort across periods at least once. The observed distribution of effort choices, discriminating between constant and inconstant choices, does not differ significantly between the two treatments of asymmetric information and social identity ($\chi^2_{df=2} = 3.87, p = .15$). Generally, subjects invest on average 77% of their available wage earnings in assets. The results of a Mann-Whitney test indicate that the average percentage of investments with respect to wage earnings does not differ significantly between treatments ($z = 0.37, p = .71$).

In order to disentangle domestically biased investments from own company investment, the data for the following analyses exclude own company investments. We calibrate investments in the remaining two domestic firms with respect to the three foreign firms. More precisely, the data of domestic as compared to foreign investments are adjusted in the proportion 2:3 since domestic data now represent only two companies in contrast to the three foreign firms. Figures I and II display domestic and foreign investments, i.e., the adjusted number of assets, across the four periods for the asymmetric information and the social identity treatment. Generally, home investment exceeds foreign investment in all periods and in both treatments.

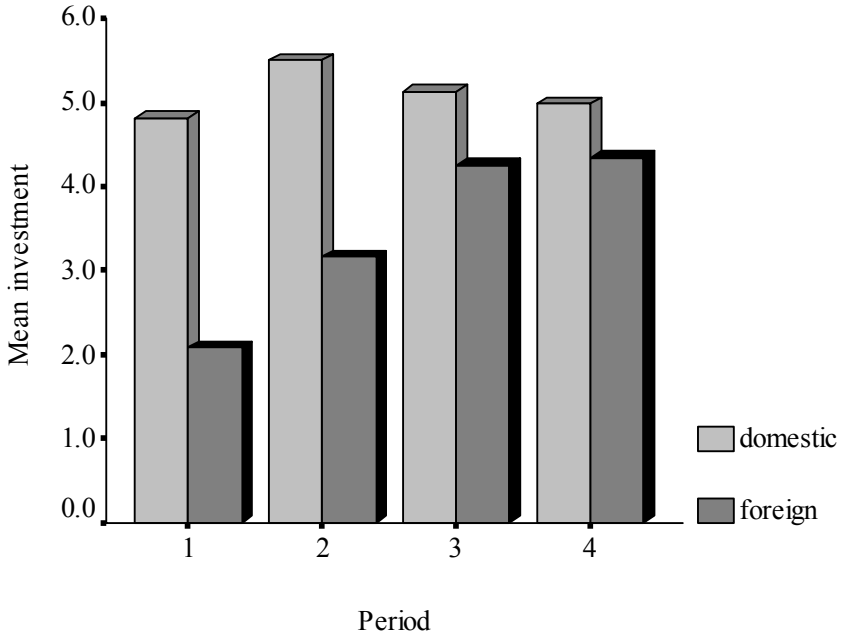

Figure I: Adjusted domestic and foreign investments in the asymmetric information treatment

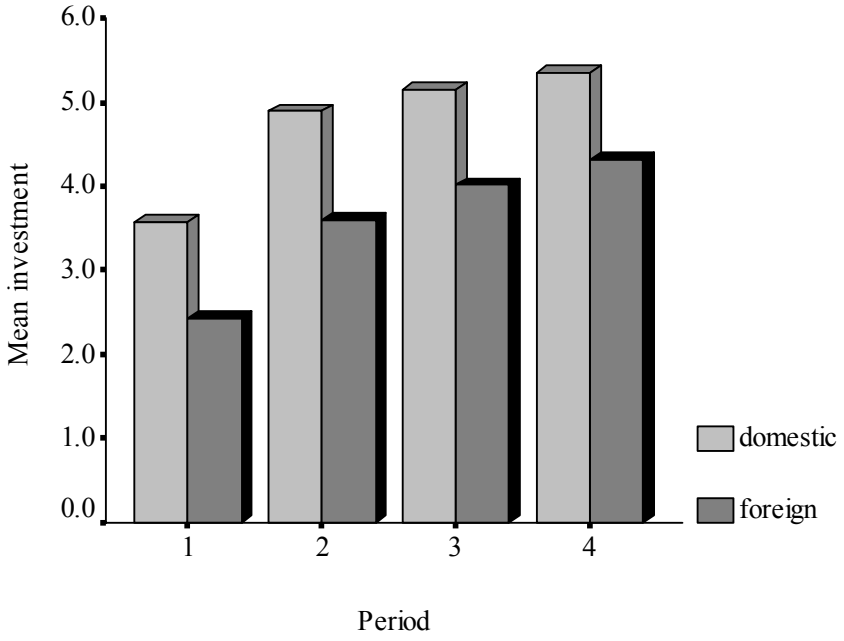

Figure II: Adjusted domestic and foreign investments in the social identity treatment

To ensure comparability between the six markets of each of the two experimental treatments in all four periods, we ran the multiple comparisons separately for home and foreign investment, using the Kruskal-Wallis test. The results indicate that markets do not differ significantly with respect to investment behavior. In the following analyses, we therefore pool the different experimental markets.

Observation 1 *Domestic investment exceeds foreign investment, both in the asymmetric information and in the social identity treatment, confirming the equity home bias.*

This observation is supported by the results of general linear models (GLM) for repeated measures with investment as dependent variable and period (1,...,4) and investment realm (domestic vs. foreign) as repeated factors. The results indicate that subjects generally invest in domestic rather than in foreign firms, and that they increase their investments over time (see Tables II and III). According to Bonferroni post-hoc tests, subjects significantly increase their investment from period 1 to subsequent periods. However, no further changes are observable from period 2 onwards. This holds true for both experimental treatments, asymmetric information and social identity. Only in the former, domestically biased investments diminish across the four periods (see Figure II), inferred from a statistically significant interaction effect between period and investment realm ($F(3;69) = 4.00, p = .01, \eta^2 = .15$). Our findings thus indicate that in the social identity treatment the difference between domestic and foreign investment remains stable across repetitions, whereas in the asymmetric information treatment domestically biased investments decrease.

Observation 2 *Social identity explains the equity home bias equally well as asymmetric information.*

Evidence for this observation is provided by the results of a mixed GLM and the homogeneity-Q test [for an introduction see Lipsey and Wilson 2001] for comparing effect sizes. The GLM considers investment as dependent variable, period (1,...,4) as well as investment realm (domestic vs. foreign) as repeated factors, and the between-subjects factor treatment (asymmetric information vs. social identity). Its results indicate that investments are not significantly different between the asymmetric information and the social identity treatment ($F(1;142) = 0.22, p = .64, \eta^2 = .02$). In a next step, we compare the effect

Table II: Results of a general linear model on investment behavior in the asymmetric information treatment

		Mean	Standard deviation	F (df_h, df_e)	p	η^2
Period	1	3.45	2.00	12.45	$< .001^{\star\star}$	.351
	2	4.33	1.89	(3; 69)		
	3	4.69	1.76			
	4	4.67	1.59			
Realm	Home	5.11	2.43	20.61	$<.001^{\star\star}$	.225
	Foreign	3.46	1.77	(1; 71)		

Note: ** denotes significance at the 1% level.

Table III: Results of a general linear model on investment behavior in the social identity treatment

		Mean	Standard deviation	F (df_h, df_e)	p	η^2
Period	1	3.01	1.96	20.00	$< .001^{\star\star}$	.465
	2	4.24	1.96	(3; 69)		
	3	4.58	1.94			
	4	4.83	1.87			
Realm	Home	4.74	2.34	14.64	$.001^{\star\star}$	.151
	Foreign	3.59	1.71	(1; 71)		

Note: ** denotes significance at the 1% level.

sizes of the difference between home and foreign investments for the two treatments in order to establish whether the observed home bias is stronger in one of the two. For this analysis, we use the homogeneity-Q test. Our findings indicate that the effect sizes are not significantly different between the two treatments ($Q = 1.02 < Q_{crit} = 3.84, \alpha = .05$). Our results thus suggest that the observed home bias is not better explained by either asymmetric information or social identity.

Observation 3 *Excessive own company investment is concentrated in early periods.*

This observation is supported by determining a 95% confidence interval around the median investment of one's company and comparing it to the benchmark in-

Table IV: Median percentages and confidence intervals of own company investment

	Asymmetric information		Social identity	
	Median	95% confidence interval	Median	95% confidence interval
Period 1	.27*	[.22; .33]	.25*	[.20; .33]
Period 2	.25*	[.18; .27]	.20	[.16; .26]
Period 3	.19	[.16; .22]	.17	[.16; .19]
Period 4	.20	[.16; .22]	.17	[.16; .22]

Note: * denotes overinvestment in own company stock according to the theoretical benchmark investment of one-sixth.

vestment of one-sixth of one's total investment.[8] The true value of the median investment should fall within the boundaries of the interval with 95% certainty. If the benchmark investment lies outside the lower (upper) boundary of the determined confidence interval, subjects exhibit overinvestment (underinvestment) at a significance level of 5%. Table IV reports the median percentage of own company investment and the confidence intervals for the two experimental treatments across the four periods. In the asymmetric information treatment, subjects exhibit excessive own company investment in the first two of the four periods, whereas in the social identity treatment excessive own company investment occurs just in the first period. Figure III suggests that overinvestment decreases over time. However, the results of two general linear models with the dependent variable own company investment and the repeated factor period (1,...,4) do not lend support to this conjecture, neither for the asymmetric information ($F(3; 69) = 0.64, p = .60$) nor for the social identity treatment ($F(3; 69) = 1.16, p = .33$).

Observation 4 *Investors are more optimistic about domestic than foreign production.*

Evidence for this observation is provided by the results of a Wilcoxon-signed

8 Investors might choose their individual effort choice strategically with respect to intended own company investment since high effort also increases expected firm's operating profits and subsequently dividend payments. However, even in the firm with the most favorable market situation investors are required to hold more than 57% of company stock to benefit from choosing higher effort by obtaining increased dividend payments. Our results, however, indicate that investors hold at least 57% of own company stock in less than 0.6% of all cases. Picking the high effort choice for strategic purposes, i.e., in order to invest mainly in own company stock, is not beneficial under these conditions.

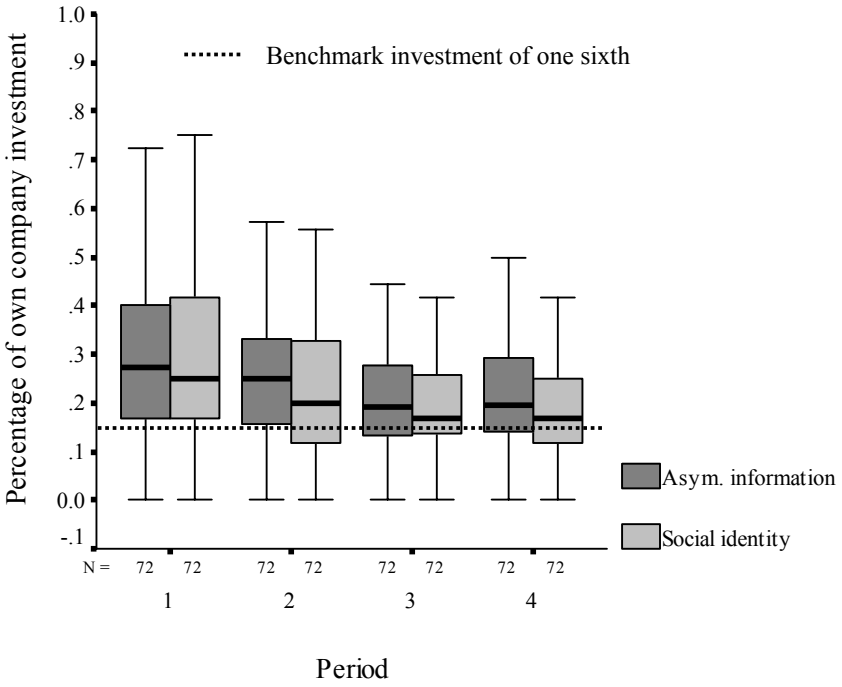

Figure III: Boxplots for own company investment across periods

ranks test. Recall that subjects are asked to rank all six firms according to their profit expectations at the beginning of each period. Optimism in domestic rather than foreign production thus requires lower ranks, on average, for home companies. Our results support this conjecture; aggregated mean ranks across periods for domestic firms are significantly lower than the corresponding ranks for foreign firms, both for the asymmetric ($z = 3.85, p < .001$) and the social identity treatment ($z = 4.46, p < .001$). To establish the time trend of aggregated mean ranks, a Friedman test on the difference between foreign and domestic ranks across the four periods is computed. Our results indicate that there is no significant change across periods in either the asymmetric ($\chi^2_{df=3} = 0.46, p = .93$) or the social identity treatment ($\chi^2_{df=3} = 7.77, p = .05$). Surprisingly, unjustified optimism is even observable in the first period of the asymmetric information treatment before subjects actually receive aggregate information on firms' profits. Generally, our findings suggest that subjects are systematically more optimistic toward home than foreign production.

V. Discussion

The idea guiding this research is to show that previous behavioral explanations for the equity home bias, a systematic shift of portfolio allocation toward the domestic market, neglect one important psychological aspect, namely social identity. The concept of social identity stresses that group affiliation leads to more favorable and positive evaluations of one's own group, and constitutes the desire to treat groups distinctly. Social identity theory has not only been applied to small group behavior but also to large group phenomena, such as national identification and ethnical conflicts.

Evidence for the relevance of group affiliation in financial decision making is, for instance, provided by sports betting markets. Bettors act against their financial interest by betting on their preferred team without sufficiently taking the odds into account. Another example stems from biased 401(k) retirement saving plans. Identification with one's company might be one of the driving forces why individuals invest excessively in own company stock, disregarding the benefits from diversification. Finally, in the business world national identification is explicitly addressed. Many manufacturers, for instance, promote their goods by highlighting their domestic origin.

In this paper we propose social identity as an additional behavioral explanation for the equity home bias. Drawing upon experimental methods, we contrast the institutional approach of asymmetric information with social identity. In the experiment pairs of subjects are randomly assigned to firms, whereby three firms are a subset of one of two distinct production groups. In the social identity treatment, we enforce group affiliation by labeling the two groups distinctively. Conversely, in the asymmetric information treatment subjects obtain aggregate information on total profits of one group. In order to increase the identification with one's firm, subjects endogenously choose their effort prior to the investment possibility, co-determining firms' profits. In both treatments optimal diversification requires equal investments across firms.

Our results show domestically biased investments, that is, higher investment in one's group excluding the own company, in the asymmetric information as well as in the social identity treatment. Moreover, social identity explains the equity home bias equally well as asymmetric information. Even in the absence of having more information on domestic companies, social forces triggered by one's identification with one's group drive underdiversified and biased portfolio allocations.

We therefore provide important evidence that by solely focusing on institutional explanations one captures the equity home bias insufficiently; social forces, like the identification with one's national companies, might play an equally important role.

More specifically, across the four periods the difference between home and foreign investment remains stable in the social identity treatment, but diminishes when asymmetric information is provided. Investors might realize that the provided information does not guarantee reliable investment success. This finding suggests learning effects. However, in contrast to our experimental analysis on real-world financial markets, new investors continuously enter, rendering it less likely that the bias wanes solely due to investor learning.

An important aspect of our study is that we are able to disentangle excessive own company investment from the equity home puzzle. Since prior to the investment choice subjects in our experiment also decide on their effort, which co-determines the firm's profit, own company investment seems spuriously attractive. However, the underlying theoretical model suggests that the profitability of own company investment depends on the random assignment of a market situation parameter and the number of total emitted shares; the more demand there is for an asset, the less are its dividend payments. Indeed, our findings indicate that excessive own company investment in both treatments prevails only in the first periods and vanishes across time. Investors correctly realize that own company investment, on average, is not a profitable strategy. Finally, we provide evidence that investors in both treatments are speciously more optimistic toward domestic production, whereby optimism does not abate over time.

An alternative approach to experimentally investigate the impact of social identity on the equity home puzzle might be to design a stochastic investment environment, in which dividend payments are not endogenized in a market setting. While this approach would allow for more straightforward benchmark calculations, it incorporates the disadvantage of providing subjects with "windfall" investment opportunities, creating an extremely artificial decision environment. Our approach, in contrast, attempts to represent real markets as closely as possible. By creating a simple two-country market in the lab, we demonstrate the importance of social forces, expressed by group identification, in explaining the equity home puzzle.

Appendix A: Proofs of Propositions 1 and 2

Proposition 1 *Individual effort choices e_i are contingent on own company investment k_{ij}, the market situation a_j, and the total asset emission of one's company $\sum_i k_{ij}$:*

$$e_i = \begin{cases} \overline{e} \text{ if } \dfrac{k_{ij}}{\sum\limits_i k_{ij}} > \dfrac{1}{3a_j} \\ \underline{e} \text{ if } \dfrac{k_{ij}}{\sum\limits_i k_{ij}} < \dfrac{1}{3a_j}. \end{cases} \tag{6}$$

Proof. By determining the first-order condition for the individual payoff function, we show that effort choices depend on the ratio of own company investment to the total number of emitted assets by a specific company, and its market parameter.

$$y_i = \overline{w} - c(e_i) - \overline{p} \sum_j k_{ij} + \sum_j k_{ij} \frac{a_j \sum_i e_{ij} - 2\overline{w} + m_j \pm 1/3 b}{\sum_i k_{ij}} \tag{7}$$

whereby $c(e_i) = \frac{1}{3} e_i$.

$$\text{FOC: } \frac{\partial y_i}{\partial e_i} = -\frac{1}{3} + \frac{a_j k_{ij}}{\sum_i k_{ij}}. \tag{8}$$

From condition 8 it is clear that the worker chooses the highest possible effort if the proportion of own company investment to the total number of emitted assets by one's own company exceeds the inverse of three times the assigned market situation parameter of the company. In the reverse case workers choose the lowest possible effort. □

PROPOSITION 2 *Optimal investment, expressed by the vector* $(X_1^\star, \ldots, X_6^\star)$*, requires to evenly distribute one's asset holdings across all six firms,* $X_j^\star = 1/6 \; \forall j$.

Proof. For determining the optimal portfolio allocation the underlying correlation structure is needed as well as the expected values and variances of firms' wealth. In our market model we assume that the firms' wealth v_j depend on the operating profits π_j and their revenues m_j. The total sum of effort choices for each firm can result in three possible states; $2\underline{e}, \underline{e} + \overline{e}, 2\overline{e}$, whereby we assume that each state is equally likely. The expected value of operating profits, for each specific market situation a_j, is determined by computing the weighted sum of profits in the three possible states. In analogy to the calculation of expected operating profits for each firm the variance of the operating profits can be determined. In order to obtain the expected values and variances of each firm's wealth one has to make assumptions about the total number of emitted assets of the firm. The derivation of the optimal portfolio, however, does not depend on the assumptions made.

Since our model allows for the risk-free investment option of holdings money, a single optimal portfolio $P = (X_1, \ldots, X_6)$ can be derived for each non-risk loving investor [Elton and Gruber 1995], whereby $X_1, \ldots, X_6$ correspond to the fractions invested in the specific firm.[9] The objective function to obtain the optimal portfolio P maximizes the ratio of excess return (expected return minus risk-free rate) to the standard deviation, subject to the constraints that the sum of proportions invested in the assets equals 1, that is, the slope of the capital market line has to be maximized under the given constraints, and no short sales are allowed:

$$max \frac{R_p - R_f}{\sigma_p} \text{ s.t. } \sum_j X_j = 1 \text{ and s.t. } X_j \geq 0 \; \forall j. \tag{9}$$

9 For convenience, we associate the realization of the market situation with a specific firm number, e.g., the market situation of *Firm 1* is a_1.

R_f denotes the risk-free rate of lending and borrowing, R_p the expected return on the optimal portfolio, σ_p the standard deviation of the return of the optimal portfolio, and X_j denotes the fraction of investor's funds invested in firm j. By employing a quadratic programming technique, one can solve for the optimal portfolio allocation.

Assume now that the vector $P^\star = (X_1^\star, \ldots, X_6^\star)$ represents the fractions that should be optimally invested in *Firms 1* to *6*. However, in our model investors lack the information which of the six firms is assigned a specific market situation parameter a_j. The only information investors can rely on is the probability distribution of a_j. Investors thus form expectations on each firm's optimal portfolio fractions by acknowledging the equal likelihoods of the firms to be assigned a specific market situation value. Per definition the optimal portfolio fractions sum up to 1, leaving the expected optimal investment in each firm to be one-sixth.

$$
\begin{aligned}
EV(X_j^\star) &= \textstyle\sum_j p(X_j = X_j^\star) X_j^\star, \text{ whereby } p(X_j = X_j^\star) = \tfrac{1}{6} \\
&= \tfrac{1}{6} \textstyle\sum_j X_j^\star \\
&= \tfrac{1}{6} \qquad \square.
\end{aligned} \tag{10}
$$

Appendix B: Instructions

In the following the instructions for the two treatments are shown. In case the two instructions differ, {} denote the asymmetric information treatment and [ ] denote the social identity treatment.

Thank you for participating in our experiment. The experiment will take about 60 minutes. Please read the instructions carefully since your payoff may depend on your understanding.

All monetary values are quoted in ECU (Experimental Currency Unit) throughout the experiment. The exchange rate ECU to € is 20:1, that is, 20 ECU equal 1 €. At the end of the experiment you will be paid out your earnings in € .
In the following the experiment is explained in details. Overall, there will be four periods.

The production process

Pairs of subjects are randomly formed to run a company. The matching is done anew in each of the four periods. {Each firm is characterized by a number. Overall, there are six firms.} [Each firm is characterized by a combine name and a number. Overall, there are two combines with three firms each. The two combines are denoted with *combine ALPHA* and *combine OMEGA*.]
Each subject chooses the effort level e independently of his/her co-worker, which can either be low, $\underline{e} = 15$, or high, $\overline{e} = 60$. Effort levels are associated with costs c, which are $c(15) = 5$ in case of low effort and $c(60) = 20$ in case of high effort. The costs of the effort level are deducted from your total earnings at the end of the periods.
For your exhibited effort you are granted a fixed wage of 36 ECU.
The profit of your firm is determined by your effort choice and the effort choice of your co-worker. In addition, the realization of a random parameter a, which captures the current market situation, affects the firm's payoff. The possible values for a are: $\frac{2}{3}, 3, 4\frac{2}{3}, 5, 5\frac{1}{3}, 7$. The determination of the values is made by drawing without replacement, which means in every period each value is only assigned once.
In the following your effort choice is referred to as e_1 and that of your co-worker as e_2. In order to determine the profit of your firm, one has to deduct the wages for the two workers first, that is, 2 times 36. The profit π of your firm is therefore:

$$\pi = a \cdot (e_1 + e_2) - 2 \cdot 36$$

Please note that the profit of your company can also be negative! In this case the firm's profit is reset to zero by the experimenter.
{In each of the four periods, you are granted *private information* about the total profits of three firms as well as their average profit.}
[As mentioned earlier, each firm is part of one of two combines. Each combine consists of three firms, whereby the firms in one combine have identical combine names, but different numbers. The remaining firms in your combine thus have the same name, but a different number. Throughout the whole experiment you will remain a part of your combine. In which firm, you will be working, however, is determined randomly at the beginning of each period.]

The investment process

{The six firms issue shares, which can be bought by the workers to participate in the firms' wealth.} [All firms, both those in your combine and the ones in the other combine, issue shares which can be bought by the workers to participate in the firms' wealth.]
Each subject can use his/her wage of 36 ECU to acquire shares of all *six* firms. The price of one share is 1. The revenues m of the firms are the product of the number of shares sold n and the share price p:

$$m = n \cdot p$$

{The wealth of each firm consists of the following components: (1) the effort chosen by the two workers (e_1, e_2), (2) the random market parameter (a), (3) the wages paid (2 times 36), (4) the firm's revenue from selling shares $(n \cdot p)$ and (5) the success of three randomly chosen firms relative to the three remaining firms. In order to determine the relative success the profits of the two groups, each consisting of three firms, are compared to one another. The firms that belong to the group with the higher total profits obtain a bonus of 10 ECU each. The same amount is deducted for the firms that belong to the group with the lower total profits. In

case of equal profits across groups, the bonus is shared among groups.
The wealth v of each of the firms is:

$$v = \begin{cases} a \cdot (e_1 + e_2) - 2 \cdot 36 + n \cdot p + 10 & \text{for those firms} \\ & \text{with the higher total profits} \\ a \cdot (e_1 + e_2) - 2 \cdot 36 + n \cdot p - 10 & \text{for the remaining firms} \\ a \cdot (e_1 + e_2) - 2 \cdot 36 + n \cdot p + 5 & \text{in case the profits are equal} \\ & \text{for the two groups}\} \end{cases}$$

[The wealth of each firm consists of the following components: (1) the effort chosen by the two workers (e_1, e_2), (2) the random market parameter (a), (3) the wages paid (2 times 36), (4) the firm's revenue from selling shares $(n \cdot p)$, and (5) the success of one combine relative to the other. In order to determine the relative success, the profits of the two combines are compared to one another. The firms that belong to the combine with the higher total profits obtain a bonus of 10 ECU each. The same amount is deducted for the firms of the combine with the lower total profits. In case of equal profits across combines, the bonus is shared among combines.
The wealth v of each of the firms is:

$$v = \begin{cases} a \cdot (e_1 + e_2) - 2 \cdot 36 + n \cdot p + 10 & \text{for those firms in the} \\ & \text{combine with the higher total profits} \\ a \cdot (e_1 + e_2) - 2 \cdot 36 + n \cdot p - 10 & \text{for the other combine} \\ a \cdot (e_1 + e_2) - 2 \cdot 36 + n \cdot p + 5 & \text{in case the profits are equal} \\ & \text{for the two combines}] \end{cases}$$

Shareholders participate in the total wealth of the firms v by dividend payments. The dividends d are determined according to:

$$d = \frac{v}{n}$$

Your payoff

Let us denote the number of shares bought by a subject with k. Your payoff y at the end of each period is therefore:

$$y = 36 - k \cdot p + k \cdot \hat{d} - c(e)$$

whereby $\hat{d}$ denotes that the dividends of different firms can have different values.

Please remember: Your payoff y consists of your wage (36) minus your expenses for acquiring shares ($k \cdot p$) plus dividend payments ($k \cdot \hat{d}$) minus the costs of your effort choice ($c(e)$).

At the end of each period you will be informed about your earnings, split up into their components.

Overall, there will be four periods. In order to determine your final payoff, one of the periods is randomly selected. Your final payoff equals your earnings in this selected period.

If you have further questions, please raise your arm. An experimenter will then answer your questions privately.

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