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Determinants of Peer Selection

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Abstract

Peers influence behavior in many domains. We study whom individuals choose as peers and explore individual determinants of peer selection. Using data from a framed field experiment at secondary schools, we analyze how peer choices depend on relative performance, personality differences, and the presence of friendship ties. Our results document systematic patterns of peer choice: friendship is the most important determinant, albeit not the only one. Individuals exhibit homophily in personality, and prefer on average similar but slightly stronger performing peers. Our results help to rationalize models of differential and non-linear peer effects and to understand reference group formation.

Keywords: Peer Effects, Peer Selection, Social Comparison, Reference Points

JEL-Codes: C93, D01, D03, J24, L23

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1 Introduction

Peer effects have been documented across many different environments: skills of classmates influence grades at school (Sacerdote, 2011), co-workers affect own performance (Bandiera, Barankay, and Rasul, 2009; Mas and Moretti, 2009), and others influence one's consumption (Kuhn et al., 2011; Moretti, 2011). Nonetheless, in many of these settings only some self-selected individuals shape behavior. This has to be taken into account when designing policies that exploit social comparisons in educational contexts or firms. Successfully implementing such policies presupposes an understanding of the formation and composition of reference groups (e.g., Carrell, Sacerdote, and West, 2013; Kőszegi, 2014; Manski, 1993). However, we do not know much about the underlying process of peer selection. Several, sometimes conflicting determinants of peer selection are conceivable. If high-performing peers serve as a reference point, they can motivate individuals to exert more effort (e.g., Abeler et al., 2011; Koch and Nafziger, 2011). Others choose peers to compete or they select specific friends, as they might make a task more enjoyable (Park, forthcoming).

In this paper, we study the selection of peers and link these choices to three potential determinants. Specifically, we measure with whom students want to interact and analyze the extent to which these preferences for specific peers depend on (i) relative performance, (ii) personality differences, and (iii) the presence of friendship ties.[1] By studying these determinants, we can quantify the magnitudes of performance and social aspects in the peer selection process and highlight their relationship.

In order to study the selection of peers, we use data from a framed field experiment with over 600 students aged 12 to 16. In the experiment, students took part in two running tasks, first alone, then simultaneously with a peer. Between the two runs, we collected two different types of preferences for peers, which were subsequently used to form pairs for the second run. More specifically, we elicited students' preferences for peers by allowing them to name up to six classmates with whom they would like to be paired (*name-based preferences*) or choose

[1] We differentiate between friends and peers as two distinct, albeit related concepts. While friends can be peers, not all friends have to be peers across all situations.

their peer's relative performance (*performance-based preferences*). Moreover, we elicited personality measures and the social network within each class. Our setup thus has four crucial features to analyze peer selection in detail. First, the classroom environment enabled students to state meaningful preferences for known peers (*name-based preferences*) allowing for social aspects. Second, using a running task yields direct measures of performance. This allows us to isolate preferences over the relative performance of peers (*performance-based preferences*), creating a preference measure for peers that abstracts from social considerations. Third, our analysis relies on preference measures. This overcomes the notion that preferences for peers may not necessarily be satisfied in observed selection outcomes, e.g. due to the limited availability of peers. Fourth, by focusing on a single peer in the second run, we circumvent issues associated with multiple reference points (Kahneman, 1992) as students interact with one peer only.

Our analysis proceeds in three steps. First, we describe the heterogeneity in both preference measures, finding that friendship ties play a crucial role. About 80% of the three most-preferred name-based peers are friends. Nonetheless, this figure declines to less than 50% when considering the fifth or sixth ranked peer. Moreover, we observe that students on average prefer slightly faster peers (0.20 SD in terms of performance in the first run). However, this masks large heterogeneities in performance-based preferences. Approximately half of the students want to interact with similar (slightly faster or slower) students. The other half prefer peers who differ in their relative performance by more than one second.

In a second step, we study the determinants of peer selection based on names. In particular, we consider the extensive – whom to select – as well as the intensive margin, namely the ranking of peers. We estimate the extent to which peer selection patterns can be explained by differences in past performance, differences in personality, and the presence of friendship ties. We find that all three dimensions matter, although friendship ties are the most important determinant. If two students are friends, this increases their nomination probability (rank) by 39 percentage points (1.7 ranks). Moreover, we find substantial homophily in both past performance as well as personality. Accordingly, students select peers with whom they are similar. A one standard-deviation difference in past performance (difference in personality) reduces the

probability of selecting a given classmate by approximately 6 percentage points (4.5 pp.) corresponding to 0.38 ranks (0.30 ranks). These homophily effects hold conditional on friendship ties: students select those friends as peers who are close to them with respect to personality and performance. Moreover, our results uncover heterogeneities across sub-groups. We show that the importance of these dimensions differs between males and females as well as high- and low-ability students. In particular, male subjects exhibit a stronger homophily in performance than female subjects.

In a third step, we explore the relationship between performance- and name-based preferences. Our results show that when students select peers based on names, they try to target their preferred relative performance level. This demonstrates that subjects nominate similar performing peers not only due to homophily, but also due to preferences over relative performance. The social dimensions of peer selection remain unaffected, which highlights the multidimensionality of preferences for peers.

This paper relates to the rich literature on peer effects. Although their importance is undisputed, evidence on whom people select as peers remains scarce. Yet, Manski (1993, p. 536) already noted that the "*informed specification of reference groups is a necessary prelude to [the] analysis of social effects*". This implies that studies on peer effects have to take a stance on who constitutes a reference or peer group, thus specifying who exerts potential peer effects. For example, it is common to specify the set of classmates or co-workers as reference groups on an ad-hoc basis. However, only parts of these groups may constitute relevant peers and misspecifications thereof attenuate peer effect estimates due to measurement error (Cornelissen, Dustmann, and Schönberg, 2017; Dube, Giuliano, and Leonard, 2019). In order to circumvent this problem and accommodate different peer definitions, a growing body of literature estimates peer effects for different groups separately, differentiating between genders (Black, Devereux, and Salvanes, 2013; Hoxby, 2000; Lavy and Schlosser, 2011) or allowing friends and non-friends to exert different peer effects (Aral and Nicolaides, 2017; Bandiera, Barankay, and Rasul, 2009, 2010). We document that friendship is the most important determinant for peer selection, thereby validating the use of friends as a proxy for peers. Moreover, our results show that people exhibit systematic peer choice patterns. This suggests that only a subset of peo-

ple serve as peers and affect behavior. In particular, this motivates the separate estimation of peer effects for different sub-groups and demographic characteristics, i.e., differential peer effects.[2] Relatedly, a student's impact may differ across the ability distribution: it might be large on classmates with similar abilities, whereas for others with vastly different ability levels the effect might be small. Non-linear peer effects implicitly incorporate these patterns of peer selection since they allow different students (e.g., in terms of their ability) to exert different effects.[3]

In general, individuals often self-select into workplaces or organizations based on institutional characteristics or individual traits. For example, employees select into workplaces based on latter's characteristics (e.g., incentive schemes, Dohmen and Falk, 2010; Niederle and Vesterlund, 2007), students and their parents choose schools based on the academic performance of the school (Burgess et al., 2014), and individuals sort into occupations and organizations based on individual traits (e.g., prosociality, Carpenter and Myers, 2010; Friebel, Kosfeld, and Thielmann, forthcoming). We advance this literature by studying the process of peer selection within those organizations or social groups. In a similar vein, Cicala, Fryer, and Spenkuch (2018) study how students choose peer groups by sorting into specific tasks based on their comparative advantage. Our approach differs and links students' peer selections to social and non-social determinants to investigate how students weight these. By this, our paper adds to a growing literature modeling the selection of friends and the formation of social networks (see for an overview Graham, 2015; McPherson, Smith-Lovin, and Cook, 2001). However, we deliberately differentiate between friends and peers as two distinct, albeit related concepts. Friendship ties may be one factor that determines whether to choose a specific individual as a peer. Although it is quantitatively the most important factor in the peer selection process, it is neither a necessary nor sufficient indicator for actual peer choices. Methodolog-

[2] In principle, differential peer effects can be due to (i) only some students being relevant peers, (ii) only some students exerting peer effects, or a combination of both.

[3] While the earlier literature on peer effects mainly studies linear in means peer effects (Manski, 1993), recent studies explicitly consider non-linear specifications in ability (e.g., Burke and Sass, 2013; Carrell, Fullerton, and West, 2009; Tincani, 2017). In principle, policy-makers can exploit these non-linearities to design reassignment rules (Bhattacharya, 2009), although the consequences of reassigning students vary across studies (Booij, Leuven, and Oosterbeek, 2017; Carrell, Sacerdote, and West, 2013; Kiessling, Radbruch, and Schaube, 2018).

ically, we adopt a similar framework to Girard, Hett, and Schunk (2015). Whereas they study friendship formation at a university and find homophily in several personality traits and economic preferences, we focus on peer selections within established social networks and allow – among other factors – friendship ties to affect these.

Our results help to develop a deeper understanding of the selection process for peers – or reference group formation more generally – which can be levered to design successful policy interventions. By reorganizing teams, organizations or groups, policy-makers can change the availability of potential peers and thereby channel peer interactions. By providing suitable peers, they can exploit the resulting effects (e.g., Roels and Su, 2014). The findings presented here might help to design policies and incentive contracts incorporating social interactions (Carrell, Sacerdote, and West, 2013; Kőszegi, 2014). We show that their effects potentially differ across sub-groups. This suggests, for example, that high-ability students select more similar peers compared to low-ability students, who place more emphasis on friendships. Therefore, separating individuals by ability should only slightly change high-ability students' reference groups. However, it might have larger effects for low-ability students, affecting subsequent behavior differentially.

Our evidence on the determinants of peer selection informs the literature on the specification and formation of reference points (see for an overview O'Donoghue and Sprenger, 2018). Selected peers can serve as an "aspiration level" or goal that constitutes a reference point, as introduced by Kahneman and Tversky (1979) and used similarly for example by Brookins, Goerg, and Kube (2017) and Koch and Nafziger (2011). Some studies (e.g., Cerulli-Harms, Goette, and Sprenger, 2019; Schwerter, 2013) debate the nature and the location of reference points. We add to this literature by demonstrating that social reference points can arise endogenously through peer selection. Heterogeneous preferences over peers highlight how reference points are linked to individual characteristics.

In our experiment, we induce peer effects by allowing for social comparisons. We analyze explicitly individual preferences for social comparisons and do not focus on their con-

sequences.[4] Only a handful of papers study to whom people compare: while some studies (Clark and Senik, 2010; Knight, Song, and Gunatilaka, 2009) find that people compare themselves to friends, co-workers or neighbors, others focus on comparisons along performance levels (Falk and Knell, 2004) or with one's own past (Senik, 2009). By contrast, ours is the first study to combine preferences along social dimensions with information about preferences for relative performance and the personality of the peer.

The remainder of the paper is structured as follows. The next section presents the data and describes our sample. Section 3 documents two kinds of preferences for peers, based on relative performance and names. We analyze the general determinants of the name-based preferences in section 4. Finally, section 5 concludes.

2 Data

In most environments, it is difficult to observe with whom people compare their own performance. This is especially difficult when there is not a single peer available as an objective standard but rather when several peers are observed at the same time. Additionally, peer selection may not only be based on preferences over some target performance; rather, it is potentially based on a much broader set of peers' characteristics.

In this paper, we use the dataset of a framed field experiment studying the self-selection of peers (Kiessling, Radbruch, and Schaube, 2018) to overcome these difficulties. The experiment elicited preferences for peers in a sample of over 600 students and thus allows us to study the peer selection process. In addition to these preferences, the experiment elicited the social network and several personal characteristics.

[4] Social comparisons may harm effort provision and work performance (Ashraf, Bandiera, and Lee, 2014; Cohn et al., 2014), reduce job satisfaction (Card et al., 2012), change consumption patterns (Kuhn et al., 2011), and negatively affect happiness and overall well-being (Clark and Senik, 2010).

2.1 Experiment

The experiment was embedded into physical education classes in German secondary schools. Subjects participated in two suicide runs, each comprising a series of short sprints along the lines of a volleyball court[5]: first, at the beginning of the experiment alone, then at the end of the experiment simultaneously with a peer. No other classmates were presented during the first or second run. For the second run, we randomly assigned classes to one of three treatment conditions, which implemented different peer assignment rules: random assignment, self-selection based on names, or self-selection based on relative performance. The treatments with self-selection of peers used the elicited preferences for peers to assign students into pairs for the second run. For this, we implemented a "stable roommate" algorithm proposed by Irving (1985) to form stable pairs. Hence, in order to be matched with their most-preferred possible peer, students had to reveal their true preferences. Students were matched within their own gender only. In order to incentivize students in both runs, we reported the individual times to teachers for grading. Moreover, students themselves were intrinsically motivated expressed by a strong interest in their individual time. Between the two runs, subjects participated in a survey. In addition to socio-demographics, the survey asked students to reveal their preferences for peers according to two dimensions and elicited several personal characteristics as well as the social network of the class. In the following, we describe each of these survey elements in more detail.

2.2 Preference elicitation

The survey elicited two distinct measures for peer preferences, which were used to implement self-selected peers in the experiment. First, we elicited preferences for situations solely based on relative performance (*performance-based preferences*). Second, we asked for preferences

[5]The exact task was to sprint and turn at every line of the volleyball court. Subjects had to line up at the baseline, from where they started running to the first line of the court (6 meters). After touching this line, they returned to the baseline again, touching the line on arrival. The next sprint took the students to the middle of the court (9 meters), the third to the second attack line (12 meters) and the final sprint to the opposite baseline (18 meters), each time returning back to the baseline. They finished by returning to the starting point. The total distance of this task was 90 meters.

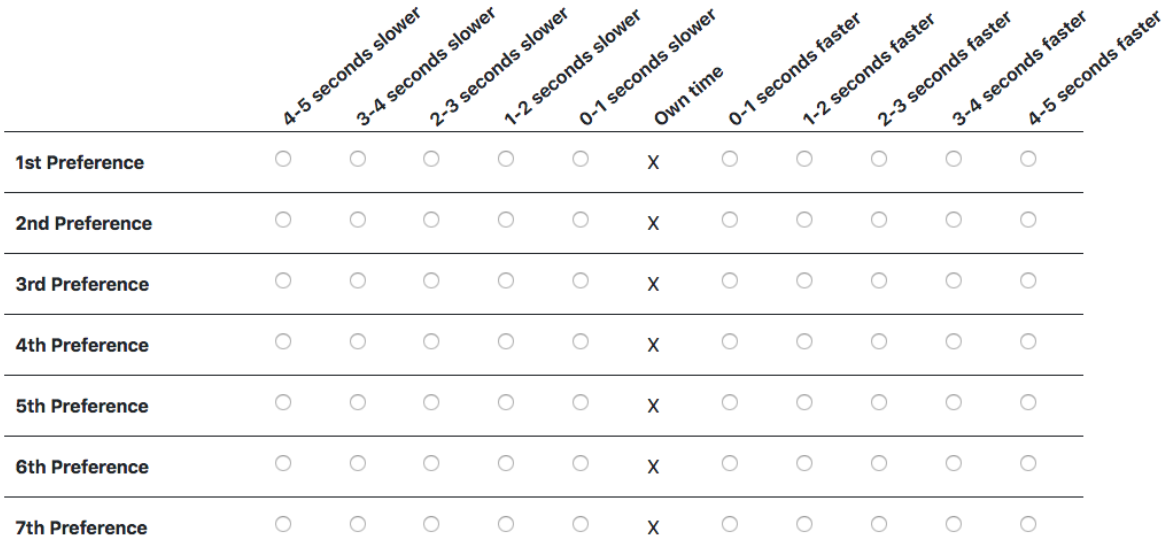
for those settings in which social information is available (*name-based preferences*). These preferences were elicited for the whole sample and independent of the treatment itself, as the treatment was only assigned after the survey took place. Note that these preferences are revealed, rather than stated preferences. In particular, there was a positive probability that these preferences were taken into account due to the random assignment of treatments after the survey.

We first discuss the elicitation of preferences for peers based on relative performance. For this purpose, the survey presented subjects with ten categories comprising one-second intervals starting from $(4,5]$ seconds slower than their own performance in the first run, to $(0,1]$ seconds slower and $(0,1]$ seconds faster up to $(4,5]$ seconds faster. We present a screenshot of the elicitation procedure in Figure 1. Subjects indicated from which relative performance interval they would prefer a peer for the second run, irrespective of the potential peer's identity. This means the students could not base their decision on any characteristics besides the relative performance. In the first row of the table, subjects indicated their most-preferred time interval and thereby the peer's relative performance. In the second row, they indicated their second most-preferred interval, and so forth. The preference for peers based on relative performance corresponds to the highest ranked time interval. We asked students to rank their seven most-preferred time intervals and therefore elicited a partial ranking of potential peers for performance-based preferences. Naturally, each time interval could only be chosen once, but it potentially included several peers. Similarly, some intervals might have been empty.

The second preference measure elicited preferences for situations in which selection can be based on the identity of the peer (*name-based preferences*), i.e., subjects could condition their decision on all known characteristics of their peers. We asked each student to state his or her six most-preferred peers from the same gender within their class. These classmates had to be ranked, creating a partial ranking of their peers.

When subjects nominated a student, they were asked to indicate their belief about the relative performance of the person. The belief elicitation was similar to that of the performance-based preferences described above: subjects had to indicate their beliefs about the performance of the potential peer in the first run using the same ten intervals and the same layout.

Figure 1: Screenshot of the survey question on performance-based peer preferences



The figure presents a screenshot of the survey module eliciting the preferences over relative performance. In particular, it elicits a partial ranking of ten categories of relative ability ranging from 4 to 5 seconds slower to 4 to 5 seconds faster.

2.3 Personal characteristics and social network

The survey also included several measures for personality traits and preferences: the Big Five inventory as used in the youth questionnaire of the German socioeconomic panel (Weinhardt and Schupp, 2011), a measure of the locus of control (Rotter, 1966), competitiveness[6], general risk attitude (Dohmen, Falk, et al., 2011), and a short version of the INCOM scale for social comparison (Gibbons and Buunk, 1999; Schneider and Schupp, 2011). For each multiple item scale, we extracted one underlying factor with a mean of zero and a standard deviation of one.

At the end of the survey, we elicited the social network of the class.[7] The elicitation asked every student to name up to six friends in their class. Due to this constraint, we focus on undi-

[6]Rather than using tournament entry decisions as measures of competitiveness, we introduced a continuous measure based on a student's agreement to four items on a seven-point Likert scale. The statements were: (i) "I am a person that likes to compete with others", (ii) "I am a person that gets motivated through competition", (iii) "I am a person who performs better when competing with somebody", and (iv) "I am a person that feels uncomfortable in competitive situations" (reversely coded). We then extracted a single principal component factor from those four items

[7]As preferences were elicited as the first part of the survey, this ordering induced the maximum possible time lag between the two elicitations. This makes potential spillovers between these two measures unlikely.

rected links. We define that friendship ties exist between person i and j if j was either nominated by student i as a friend, or j herself nominated i as a friend. This means that students can have more than six friends if they were nominated by participants who they did not nominate themselves.[8]

2.4 Summary statistics

We present summary statistics of our sample in Table 1. Overall, we have preference measures and the social network for 619 individuals from 39 classes of grades 7 to 10 (aged 12 to 16) with 66% of students being female.[9] This amounts to 73% of all students in a class participating in the experiment.[10] The average class size is about 26 and students have approximately seven friends on average, with 80% of those friends being from a student's own gender. On average, females took 27.57 seconds to finish the first run, which does not vary by age. By contrast, male performance improves with age: while the average time of males in grade 7 is 25.33 seconds, it improves to 23.21 seconds in grade 10.

3 Preferences for peers

In this section, we describe two types of preferences for peers: first, students could select their most-preferred relative performance (*performance-based preference*); and second, students could select their preferred peers based on names (*name-based preferences*), allowing students to condition their peer choice on all characteristics known to them. These two distinct pref-

[8] About 79% of the students nominated six friends. Thus, we were concerned that a maximum of six friends might be restrictive and accordingly define friendships as undirected rather than directed links. In robustness checks, we explore different friendship definitions, whereby our results are robust to using different definitions, such as directed and reciprocal friendships.

[9] These classes are from three Germany secondary schools from the highest track, preparing students for university entry after grade 12 (*Gymnasien*).

[10] Only those students who submitted parental consent forms prior to the experiment, who did not choose to abstain from the study (which nobody did), and who were not absent from the physical education lesson took part in the study. Since students did not know the exact date where the study took place, we do not have any concerns about study-related absences from the classes.

Table 1: Summary statistics

	7th grade	8th grade	9th grade	10th grade	Total
Socio-Demographic Variables					
Age	12.77	13.80	14.76	15.82	14.51
	(0.48)	(0.45)	(0.39)	(0.53)	(1.22)
Female	0.60	0.61	0.66	0.73	0.66
	(0.49)	(0.49)	(0.47)	(0.45)	(0.47)
Number of friends	6.93	7.18	7.01	6.50	6.86
	(1.35)	(1.75)	(1.57)	(1.70)	(1.63)
Share of friends of own gender	0.84	0.75	0.85	0.75	0.80
	(0.19)	(0.24)	(0.20)	(0.26)	(0.23)
Times (in sec)					
Time 1 (Females)	28.03	27.06	27.32	27.81	27.57
	(2.75)	(2.06)	(2.28)	(2.71)	(2.50)
Time 1 (Males)	25.33	24.18	23.60	23.21	24.04
	(1.93)	(2.02)	(1.82)	(2.11)	(2.11)
Class-level Variables					
# Students in class	25.54	25.97	26.29	25.01	25.68
	(2.71)	(1.96)	(2.56)	(3.17)	(2.74)
Share of participating students	0.75	0.69	0.77	0.71	0.73
	(0.11)	(0.14)	(0.16)	(0.13)	(0.14)
Observations	123	122	179	195	619

erence measures allow us to describe students' peer selection, namely who they prefer as a peer.

3.1 Performance-based preferences

As described in section 2, we elicited a partial ranking over ten categories, with each category corresponding to a one-second time interval of relative performance. Figure 2 presents the preferences for the relative performance of peers. First, turning to the distribution of the most-preferred relative performance (Figure 2a), we find that students prefer performances from the entire possible set. Some students prefer peers who are 4 to 5 seconds slower, whereas others prefer peers who are up to 4 to 5 seconds faster than their own performance. Second, around half of the students prefer similar performing peers, i.e., their most-preferred peer has a performance within one second of their own performance in the first run. Finally, the majority of

students prefers faster peers: the median of the distribution lies in the category with slightly faster peers and on average students prefer peers who were .56 seconds faster in the first run, corresponding to .20 SD in terms of performances in the first run. Figure 2b shows the relationship of the first performance-based preference with the second and third one. We observe that the second and third preference are centered around the first performance-based preference.[11] Moreover, Appendix Figures A.2a and A.2b reveal that the distributions across genders is similar, with males preferring somewhat faster peers than females: while males prefer peers who are .90 seconds faster (.31SD in terms of performances in the first run), females select peers who are .38 seconds (.13SD) faster.

Figure 2: Preferences for relative performance

(a) Distribution of preferences (b) Relationship among preferences

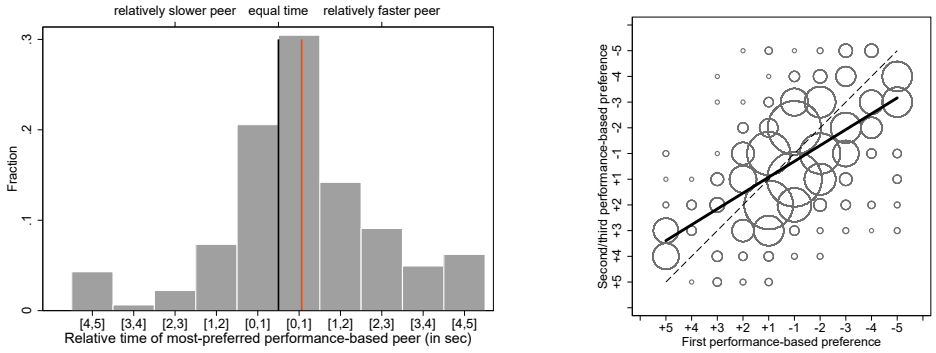


Figure (a) presents a histograms of students' preferences over relative performance. The intervals used here and in the survey are one-second intervals of relative performances in the first run. Vertical lines indicate own performance (black; equals zero by definition) and mean preference (red; where we used the midpoint of each interval to calculate the mean). Figure (b) presents the relationship of the first performance-based preference and the second/third preference.

In general, these preferences partially support the conjecture of Festinger (1954, p. 121) that people compare themselves with others who are "close to [their] own ability" and are in line with evidence from other disciplines noting tendencies to engage in upward comparisons

[11] In Appendix Figures A.1a and A.1b, we present the distributions of the second and third highest ranked interval. While the probability mass in these histograms is shifted away from an individual's own performance, this is simply an artifact of the limited number of categories, as can be seen in Figure 2b. The categories in which students preferred a much faster or much slower peer as the first preference naturally show a different pattern due to censoring. This explains why we do not find a perfect relationship with a slope of 1. When estimating a Tobit model accounting for censoring at the lower and upper limit, the regression coefficient on the second preferences is .97 with a standard error of .05 and we cannot reject that the coefficient equals unity.

(e.g. Huguet et al., 2001). Nonetheless, this does not hold for all of our subjects. In particular, there is a sizable share of students preferring peers who do differ in ability.

3.2 Name-based preferences

The second set of preferences allows students to state their preferences by selecting peers from a list of their classmates' names. In contrast to performance-based preferences, in principle students can take into account all information known to them when selecting their preferred peer.

Table 2: Share of name-based preferences who are friends

Name-based preference	1st	2nd	3rd	4th	5th	6th	Average
Share of peers being friends	0.89	0.79	0.73	0.60	0.49	0.41	0.65

This table presents the share of nominated peers for each of the six name-based preferences elicited in the survey who are friends.

Table 2 presents the share of selected peers who are also friends of an individual. While 89% of all individuals select a friend as their most-preferred peer, this number decreases by about 10 percentage points for each of the following, lower ranked nominations. This pattern might be partially driven by the fact that students do not have a sufficient number friends of the same gender in the class who they can select. Nonetheless, our data shows that students have on average about seven friends, of which 78% are of their own gender, implying that students on average have 5.3 same-sex friends who they could select (see Table 1). Thus, this finding shows that students predominately consider their friends as peers, which is also confirmed by our more formal analysis below. However, they do not solely choose their peers based on friendship ties. Some students seem to avoid some of their friends in favor of other class members.

4 Determinants of peer selection

In order to more formally explore the underlying determinants of peer selection, we analyze how the three fundamental dimensions – performance, personality, and friendship – affect who is selected as a peer and quantify the relative importance. For our analysis, we use a nomination model similar to the social network formation literature (e.g., Girard, Hett, and Schunk, 2015). As students could nominate more than one potential peer and had to rank them, we can analyze the event that someone is nominated in the name-based preference elicitation and additionally study their rank among the selected peers. We therefore investigate the extensive and intensive margins of the selection process and highlight associated heterogeneities. In a second step, we look at the role of one determinant – the preferences for a relative performance – in greater detail. In particular, we analyze the extent to which students target their performance-based preferences.

4.1 Empirical strategy

In order to analyze the determinants of peer selection in a structured way, we proceed in two steps. First, we analyze the extensive margin of peer selection. Let y_{ij} equal one if individual i nominates individual j and zero otherwise. The dataset therefore contains one observation for each possible nomination within a group. In our main analysis, we define a person to be selected as a peer if this person is part of the first three nominated name-based peers, i.e., if she is one of the three students who somebody would be most willing to be paired with in the second run.[12] We want to understand the extent to which i's nomination of j depends on three determinants: (i) differences in terms of performance in the first run ($\Delta^t(t_i, t_j)$), (ii) differences in personality ($\Delta^p(p_i, p_j)$), and (iii) the presence of friendship ties (F_{ij}). Additionally, we allow for individual-level heterogeneity in terms of observed and unobserved characteris-

[12] Accordingly, we define $y_{ij} = 1$ if and only if j is nominated in i's first three name-based preferences and $y_{ij} = 0$ otherwise. Given that groups were normally not very large and – as shown in Kiessling, Radbruch, and Schaube (2018) – 81% of students were matched with one of their first three preferences in the name-based matching, we consider those individuals as the most important ones. Our results are robust to this cut-off. In the Appendix, we relax this definition and consider different cut-offs. Panel A of Appendix Table B.2 presents the results and shows that they qualitatively and quantitatively similar.

tics by including either individual characteristics ($\Omega_{ij} = \lambda X_i + \pi X_j$) or individual-level fixed effects ($\Omega_{ij} = \nu_i + \nu_j$) as well as some idiosyncratic shock (ϵ_{ij}) for each nomination. Our main specification is therefore given by:

$$y_{ij} = \underbrace{\alpha \Delta^t(t_i, t_j)}_{\substack{\text{Differences} \\ \text{in performance}}} + \underbrace{\beta \Delta^p(p_i, p_j)}_{\substack{\text{Differences} \\ \text{in personality}}} + \underbrace{\gamma F_{ij}}_{\substack{\text{Friendship} \\ \text{ties}}} + \underbrace{\Omega_{ij}}_{\substack{\text{Controls for} \\ \text{heterogeneity}}} + \epsilon_{ij} \tag{1}$$

In our application, we measure differences in terms of the Euclidean distance of the respective characteristic. Hence, similarity in terms of past performance is measured by the absolute distance $\Delta^t(t_i, t_j) = |t_i - t_j|$. In order to measure the difference in personality, we combine the set of standardized personality measures elicited in the survey (Big Five, locus of control, competitiveness, attitudes to engage in social comparisons and risk attitudes) to define the distance $\Delta^p(p_i, p_j) = \sqrt{\sum_k (p_{ik} - p_{jk})^2}$ with k indexing different personality measures.[13] Therefore, the coefficients α and β can be interpreted as the influence of differences in past performance and personality on the likelihood of nominating someone as a peer. Negative coefficients ($\alpha < 0$, $\beta < 0$) provide evidence of homophily, namely the tendency of individuals to select others with similar characteristics (McPherson, Smith-Lovin, and Cook, 2001). Similarly, positive coefficients ($\alpha > 0$, $\beta > 0$) support heterophily, namely the tendency to avoid others who are similar.

In a second step, we study the intensive margin of peer selection. We adopt the same specification as for the extensive margin (equation 1), with two crucial modifications: first, we restrict the sample to all individuals who have been nominated as peers; and second, we change the dependent variable to be j's rank in i's preferences. For this, we define y_{ij} to the rank that individual i assigns individual j in the nomination process. The highest ranked peer receives a score of 6 and this score decreases by one with each rank in the preferences.[14]

[13] In robustness checks, we allow each of these personality measures to enter separately to explore what is driving the estimated effects. The advantage of the index is that it reduces the degrees of freedom and yields a single coefficient, which makes the impact of personality easily comparable to absolute differences in performances.

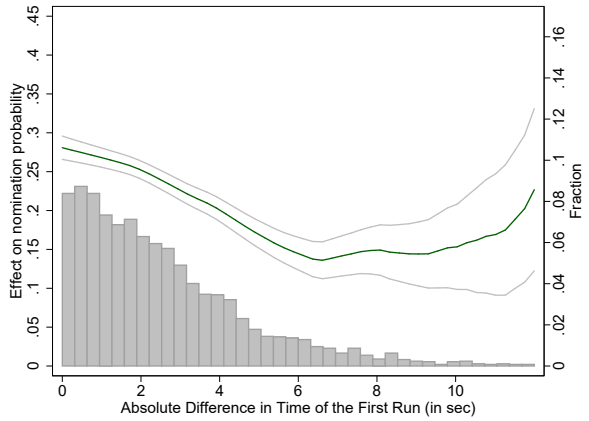
[14] The exact score does not matter for our estimates, as the level is taken out by individual fixed effects. For the interpretation of the results, it is important to note that there is a difference of one between the scores.

4.2 Extensive margin of peer selection

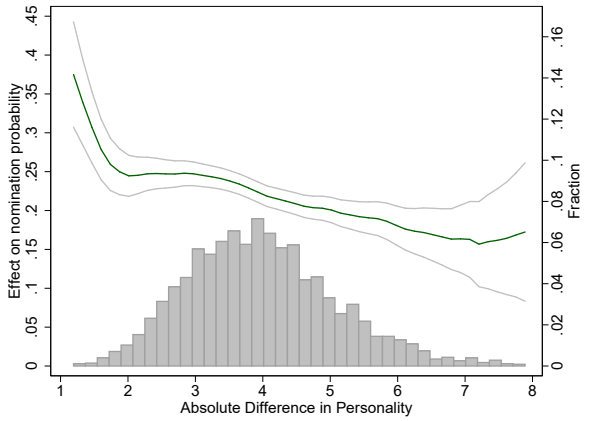
We begin our analysis by studying the extensive margin of peer selection, i.e., who individuals select as peers. Figure 3 provides first evidence of systematic peer selection patterns. Figure 3a shows that as the difference in initial performance between two individuals increases, the likelihood of nominating the other as a peer decreases. Similarly, Figure 3b shows a similar trend for differences in personality. Taken at face value, these relationships point towards homophily in both performance and personality. Yet, these associations could be driven by a common underlying factor (e.g., friendship ties) and potentially measure the same effect.

Figure 3: Extensive margin of peer selection

(a) Effect of performance differences



(b) Effect of personality differences



These figures present local linear regressions of peer nominations on (a) absolute differences in initial performance and (b) absolute differences in personality including 95% confidence intervals. The underlying histograms show the distribution of the respective regressor.

In order to disentangle the contribution of different factors in the peer selection process, Panel A of Table 3 presents a more structured analysis of the extensive margin. In particular, we estimate equation 1 using own and peer characteristics as well as class fixed effects in column (1), as well as individual and peer fixed effects in column (2). The results show that friendship ties are the most important determinant of peer selection. If two students are friends, this increases the nomination probability by 38 percentage points. However, we also find evidence of homophily in terms of both performances in the first run as well as personality. According

to the estimates in column (2), a one-second difference in past performance or a difference of one standard deviation in personality reduces the probability of nominating a person by 3-4 percentage points. While these effects initially seem modest compared to the effect of friendship ties, it is necessary to take into account the underlying distributions of these variables. Conditional on friendship ties, increasing the absolute difference of performances in the first run by one standard deviation (2.10 sec) reduces the nomination probability by 6.3 percentage points. Similarly, increasing the difference in personality by one standard deviation reduces nomination probability by 4.5 percentage points.[15] Moreover, comparing columns (1) and (2) reveals that controlling for unobserved individual-level heterogeneity is important. Individual fixed effects allow us to capture this heterogeneity and thus controls for e.g., the popularity of students, which is otherwise unmeasured.

In order to understand the relationship between those three dimensions of peer selection, we analyze their interactions in column (3). We find that differences in performance and personality do not interact and seem to be independent, whereby the resulting coefficient is close to zero and precisely estimated. Although the coefficient of friendship ties interacted with absolute differences in personality is negative – suggesting stronger homophily in personality among friends – this effect is insignificant at conventional levels. Interestingly, we find that existing friendship ties increase the importance of differences in past performance. The homophily among friends almost doubles from 3 percentage points to 5.4 percentage points for a one-second difference in initial performance. Additional support for these results are presented in column (4). Here, we restrict the sample to the set of friends and thus ask whether the effects carry over to selection among friends. Homophily effects remain significant and even increase in magnitude. Hence, the peer selection effects estimated here are distinct from homophily that is often present in friendship formations (e.g., Girard, Hett, and Schunk, 2015; Selfhout et al., 2010).[16] Even conditional on being part of someone's social network, students select only those friends as peers who share similar characteristics.

[15] Appendix Table B.1 presents summary statistics of the absolute differences in these characteristics.

[16] Appendix Table B.1 documents that the average absolute difference is only slightly smaller for the sets of friends relative to the overall sample, indicating only a modest degree of homophily in *friendship* nominations.

Table 3: Extensive and intensive margin of peer selection

	(A) Peer Nominated				(B) Peer Nomination Ranking	
	(1)	(2)	(3)	(4)	(5)	(6)
Abs. Diff. in Time of First Run	-0.016***	-0.030***	-0.030***	-0.058***	-0.178***	
	(0.003)	(0.005)	(0.009)	(0.012)	(0.035)	
Abs. Diff. in Beliefs over Times in First Run						-0.184***
						(0.051)
Friendship Indicator	0.381***	0.392***	0.515***		1.710***	1.756***
	(0.014)	(0.017)	(0.049)		(0.115)	(0.118)
Abs. Diff. in Personality	-0.017***	-0.040***	-0.040***	-0.092***	-0.270***	-0.261***
	(0.004)	(0.009)	(0.009)	(0.024)	(0.073)	(0.079)
Abs. Diff. in Time of First Run × Abs. Diff. in Personality			0.002			
			(0.002)			
Abs. Diff. in Time of First Run × Friendship Indicator			-0.024***			
			(0.007)			
Abs. Diff. in Personality × Friendship Indicator			-0.016			
			(0.011)			
Controls for heterogeneity	Characteristics	Fixed effects	Fixed effects	Fixed effects	Fixed effects	Fixed effects
Sample	All	All	All	Friends only	All	Beliefs
Observations	6654	6646	6646	2872	2756	2756
Individuals	612	612	612	612	612	612
R^2	0.26	0.37	0.37	0.37	0.40	0.39

Panel A presents the results from the extensive margin analysis using a linear probability model according to equation 1 with an indicator of being nominated as one of the three most-preferred name-based peers as the dependent variable. Column (4) restricts the sample to the set of friends. Panel B presents results of the intensive margin using the ranking among those who are nominated as peers. While column (5) uses homophily in performances from the first run, we use beliefs over relative past performance rather than actual relative performance in column (6). Standard errors are shown in parentheses and clustered at the class level. *, **, and *** denote significance at the 10, 5, and 1 percent level.

To understand which personality facets are driving the results, we decompose aggregate impact of personality in Appendix B.3 by allowing all personality measures to enter the model separately. The results show that the effect mainly stems from homophily in agreeableness, tendencies to engage in social comparisons, and – to a lesser extent – competitiveness. Importantly, the coefficients on absolute differences in performances of the first run and the presence of friendship ties remain constant, indicating that the aggregation to a single distance measure does not seem to be restrictive. Moreover, we consider different definitions of friendship ties. While in our main specification of Table 3 we defined friendship ties as undirected, we consider directed and reciprocal friendships in Appendix Table B.4. The coefficient on the friendship indicator increases when using those alternative definitions, which arguably measure more intense friendships, although coefficients on absolute differences in performance and personality remain unaffected. This is reassuring as it alleviates the concern that the homophily terms in peer selection are mere artifacts of different friendship intensities.

4.3 Intensive margin of peer selection

Although the extensive margin analysis highlights whom students consider as peers, it reveals little about their relative importance. Since peers had to be ranked explicitly, we can exploit this information to more closely explore what makes a peer relatively more important. Panel B of Table 3 focus on this intensive margin of the peer selection process by analyzing the determinants of a peer's rank. Again, we estimate equation 1, but adjust the dependent variable as described in section 4.1. Column (5) replicates the analysis of column (2), but uses the peer's rank as an outcome and restricts attention to all classmates that appear in the first six name-based peer preferences.[17] We find similar determinants for the ranking of peers as for the extensive margin: on average, friends are ranked 1.71 ranks higher than non-friends and students exhibit homophily in performance in the first run as well as in their personality. In particular,

[17] In order to analyze the ordering, we exploit the whole ranking of peers to increase power rather than analyzing the subset of the three most-preferred peers as for the extensive margin.

we find that the rank of a peer decreases by .18 ranks for each one-second time difference and by .27 ranks for each one standard-deviation difference in personalities.[18]

For the preceding analysis, we used absolute differences in past performances as a determinant of peer preferences. However, students in the experiment were not informed about their times in the first run, nor about those of their classmates. Accordingly, they had to rely on their beliefs about the relative performance of their peers when choosing them. We therefore check the robustness of our results by including the beliefs over relative performance rather than actual relative performance in column (8) and find that this does not affect our results.[19] As a second robustness check, we retain all classmates and estimate a Tobit model, in which the ranking is censored. The idea here is that all students who were not nominated have a lower rank than those who were nominated, but we do not observe their exact ranking.[20] In Panel B of Appendix Table B.2, we document that the results are qualitatively similar, although friendship ties become even more important than in our main specification. In summary, our results show that the results from the extensive margin analysis carry over to the intensive margin.

4.4 Heterogeneities in name-based preferences

While the previous sections have documented robust evidence of homophily in the peer selection process, different groups may choose peers differently. In order to predict the effects of different policies such as assigning students into classrooms or workers into teams, it is important to understand whether peer selection patterns differ across observable characteristics.

[18] Column (2) of Table B.3 in the Appendix splits up the aggregated personality measure. Similar to the extensive margin, we observe that agreeableness and the extent of engaging in social comparisons underlie the observed homophily in personality. More specifically, a one standard-deviation larger difference in agreeableness or social comparison attitudes is associated with a decrease of 0.25 and 0.16 ranks, respectively.

[19] Note that we only elicited beliefs over relative performance for those students who were nominated as peers. Hence, we can only conduct this robustness check for the intensive margin and not for the extensive one. Nonetheless, as our results reveal, our conclusions neither change in a qualitatively nor quantitatively sense when using beliefs rather than actual performances. In fact, Appendix C shows that beliefs and actual relative performance are strongly related to each other and validates their consistency. For this, we lever a second belief elicitation over the relative performance of the peer in the first run that was elicited just before the second run took place. This second belief measure and the one used in the elicitation of name-based preferences are indeed highly correlated, indicating that the beliefs are meaningful.

[20] Since we coded the highest ranking as 6, we code all students who are not part of the six most-preferred peers as 0.

Hence, we now shed light on the underlying heterogeneity of our estimates across sub-groups. Motivated by policies interested in promoting females or targeting low-ability students, we analyze whether males and females as well as high- and low-ability students select peers differently.

We present heterogeneities by gender and initial performance in Table 4. Columns (1) and (2) split the sample by gender and reveal some profound differences in the peer selection behavior of males and females. In particular, we find that males exhibit significantly stronger homophily in past performance as well as personality. By contrast, females seem to emphasize the presence of friendship ties more, although we cannot reject the hypothesis that the effect is the same across genders. In columns (4) and (5), we check for heterogeneities in ability. More specifically, we perform a median split of times in the first run within each gender and grade, and estimate equation 1 separately for both groups. The effect of friendship ties is more pronounced for slower students, while faster students show larger homophily effects in personality. Heterogeneities at the intensive margin are qualitatively similar as shown in Appendix Table B.5.

These results highlight differential peer selection across different sub-groups. These findings have to be taken into account when thinking about peer or group assignment policies. Moreover, differences in peer selection criteria help to understand why peer effects work differently across different groups: if high-ability students exhibit strong homophily in their peer selection, they will tend to select other high-performing students as peers. Nonetheless, low-ability students choose their friends as peers, who may have low or high ability.

Table 4: Heterogeneities on the extensive margin of peer nominations

	Peer Nominated					
	(1) Males	(2) Females	(3) p-value	(4) Low Abil.	(5) High Abil.	(6) p-value
Abs. Diff. in Time of First Run	-0.057***	-0.027***	0.089	-0.022**	-0.042**	0.768
	(0.016)	(0.005)		(0.010)	(0.016)	
Friendship Indicator	0.348***	0.400***	0.257	0.434***	0.358***	0.004
	(0.039)	(0.020)		(0.021)	(0.022)	
Abs. Diff. in Personality	-0.105***	-0.025***	0.002	-0.027**	-0.047***	0.067
	(0.020)	(0.009)		(0.012)	(0.010)	
Controls for heterogeneity	Fixed effects	Fixed effects		Fixed effects	Fixed effects	
Observations	1408	5238		3303	3244	
Individuals	207	405		308	301	
R^2	0.39	0.35		0.44	0.43	

This table replicates Panel A, column (2) of Table 3 for different sub-samples. More specifically, it presents results from the extensive margin analysis using a linear probability model according to equation 1 with an indicator of being nominated as one of the three most-preferred name-based peers as the dependent variable. Columns (1) and (2) analyze male and female sub-samples, whereas columns (4) and (5) focus on high and low ability, defined according to the gender- and grade-specific median performance in the first run. Columns (3) and (6) present p-values of tests of equality between the two preceding columns. Standard errors are shown in parentheses and clustered at the class level. *, **, and *** denote significance at the 10, 5, and 1 percent level.

4.5 Targeting of preferred relative performances

Finally, we examine the role of the preferred relative performances for the peer selection process and examine the relationship between the two sets of preferences. More specifically, we analyze the extent to which students target a relative performance level in the name-based selection process. In Appendix D, we provide graphical evidence on the relation between the preferred relative performance and the selected peers. We observe that both set of preferences are positively associated with each other but not perfectly related. Our preferred explanation for this imperfect relation is the fact that preferences for peers are multi-dimensional. They do not stem from a single factor, but rather are determined by the interplay of several factors.[21] Therefore, we ask whether students target peers with certain performance levels similar to their own, as indicated by the homophily documented in the previous section, or whether they try to target their preferred relative performance when selecting peers based on names.

In order to illustrate the notion that preferences for peers are indeed multi-dimensional, we enrich our previous model. In particular, we include the absolute deviation of a name-based peer's performance from the most-preferred performance in the peer selection model in equation 1. Table 5 presents the results of this exercise analogous to Table 3.

Focusing on the extensive margin of the selection process in Panel A, we observe that the estimated homophily in past performance is much smaller than documented in Table 3. Instead, there is a sizable effect of targeting one's preferred relative performance, with highly significant coefficients ranging between 1.0 and 4.9 percentage points. At the same time, the point estimate for differences in performance remains negative in all specifications and significant in some. Together, these two effects are similar in size to the homophily in performance documented in Table 3. Thus, students mainly select individuals who are close to their most-

[21] A second possible explanation is that the true relation is indeed perfect and measurement error attenuates this association. Subsequently, given a true coefficient of unity, the estimated coefficients correspond to the attenuation factor λ. Using the relationship $\lambda = 1/(1+s)$ with s being the noise-to-signal ratio (Cameron and Trivedi, 2005, p. 903f.), we can calculate s. Based on the estimates in Table D.1, in which we regress the preferred relative performance on a student's belief over the relative performance of her most-preferred peer, we obtain a coefficient $\hat{\beta} = 0.44$, implying $s = 1.27$. This ratio exceeds one, implying that the beliefs would need to contain more noise components than actual information. We thus conclude from this that measurement error alone is unlikely to be the sole cause for the imperfect relationship.

preferred performance (targeting of specific relative performances) but they also select peers who are close to their own performance (homophily in performances). Importantly, the other coefficients on friendship ties and personality differences remain unaffected by the inclusion of the preference for relative performance.[22] This highlights that the previous results are not a mere artifact of a preference for a specific relative performance; rather, it provides evidence that additional social dimensions are important for the peer selection process beyond mere reference points in performance.

If we concentrate on the intensive margin of the selection process in Panel B, a similar picture emerges: the absolute difference from the most-preferred relative performance is a strong predictor for the ranking among selected peers. A one-second increase in differences between the nominated peer's performance and the most-preferred relative performance leads to a decrease of .15 ranks for that peer. Again, the coefficient for homophily in performance is much smaller than before. The remaining determinants are unaffected by the inclusion of the preference for relative performance. Column (4) confirms these results using beliefs rather than actual performance. Unlike the specification with actual performance, beliefs over relative performance remain significant when including deviations from the preferred performance.

These results highlight that preferences over a peer's relative performance play a crucial role when selecting peers. While the most-preferred relative performance and the performance of the selected peer are strongly related, these measures do not coincide perfectly; rather, individuals also take into account other dimensions such as peers' similarity in terms of past performance and personality as well as existing friendship ties. By selecting peers based on their names, students can therefore condition on a richer information set. This suggests that social comparisons incorporate classical conceptualizations of reference points for effort provision, but they also depend on social factors.

[22] Similar to the estimates previously presented, we split the personality index in its components in Appendix Table D.3

Table 5: Targeting of preferred relative performances

	(A) Peer Nominated			(B) Peer Nomination Ranking	
	(1)	(2)	(3)	(4)	(5)
Abs. Diff. in Time of First Run	-0.007*	-0.012*	-0.016	-0.052	
	(0.004)	(0.006)	(0.014)	(0.048)	
Abs. Diff. in Beliefs over Times in First Run					-0.149***
					(0.051)
Abs. Diff. from Perf.-based Preference	-0.010***	-0.022***	-0.049***	-0.150***	-0.175***
	(0.003)	(0.006)	(0.011)	(0.043)	(0.029)
Friendship Indicator	0.381***	0.392***		1.705***	1.722***
	(0.014)	(0.017)		(0.117)	(0.121)
Abs. Diff. in Personality	-0.017***	-0.039***	-0.094***	-0.269***	-0.260***
	(0.004)	(0.009)	(0.023)	(0.072)	(0.076)
Controls for heterogeneity	Characteristics	Fixed effects	Fixed effects	Fixed effects	Fixed effects
Sample	All	All	Friends only	All	Beliefs
Observations	6654	6646	2872	2756	2756
Individuals	612	612	612	612	612
R^2	0.26	0.37	0.37	0.40	0.41

This table presents the results of the linear probability model according to equation 1 using an indicator of being nominated as one of the three most-preferred name-based peers as the dependent variable and the absolute deviation from the most-preferred relative performance as an additional explanatory variable. Standard errors are shown in parentheses and clustered at the class level. *, **, and *** denote significance at the 10, 5, and 1 percent level.

5 Conclusion

Whom do individuals choose as peers? Answering this question is crucial to understand how peer effects work and how to design policies leveraging them. We use data from a framed field experiment and study preferences for peers to shed light on this issue. We find that students choose their peers predominantly but not exclusively along their social network. Friendship ties drive peer selections, but students in our sample exhibit significant homophily in terms of both performance as well as in their personality. Interestingly, among friends, similarity in performance becomes even more important for peer selection. While male students choose more similar peers than females, low-performing students emphasize friendships more than their high-performing counterparts. By eliciting the desired relative performance of a peer, we find that most student prefer peers with slightly higher but similar performance, which is in line with findings in social sciences (e.g., Blanton et al., 1999; Huguet et al., 2001). When selecting peers, students target a specific relative performance. Peer selection is therefore based on homophily in personality, friendship ties and a desired performance level.

Our results have important implications for estimating peer effects, designing mechanisms with social preferences and policy interventions. First, if friends are more likely to be chosen as peers, this could give rise to relatively larger impact of friends compared to non-friends. Similarly, if individuals choose peers with specific performances, these preferences may result in those peers exerting stronger effects than others. The evidence presented in this paper therefore provides a rationale for estimating models of differential (in terms of gender and friends) or non-linear peer effects (in terms of own and peer ability). Second, by demonstrating to whom individuals compare their performance we inform theories of reference group formation. These insights in turn can be used to predict the effect of reorganizations and incentive contracts in a theoretically-disciplined manner (Ederer and Patacconi, 2010; Kőszegi, 2014). Finally, by using reassignment policies, teachers or managers influence the set of people from whom one can choose peers. On the one hand, these policies can have unintended consequences if sub-groups emerge (Carrell, Sacerdote, and West, 2013). On the other hand,

policy-makers that are aware of such preferences for peers can provide suitable peers and hence indirectly affect peer selection.

The preferences for peers analyzed in this paper and their link to personal characteristics might be specific to situations where only own performance matters and with competitive components. Other peers might be selected in cooperative settings. Nevertheless, we demonstrate that the heterogeneity in social reference points and peer selection is based on systematic patterns of past performance, personality and friendship ties. These determinants are also likely to matter in other settings.

At the same time, our results open avenues for new interventions and research projects: if some peers exert positive effects on an individual's performance, can we encourage individuals to select into specific peer groups that help them to unfold their full potential? Relatedly, are students aware how their peers affect their own performance? Both of these issues raise the question whether preferences for peers would change if we provide individuals with information about peer effects or even "nudge" people to select specific peers. Our results are therefore a first step towards understanding the different aspects underlying peer choices. Future research on the interaction of personality, selection into environments and the influence of peers is needed to improve our understanding of social comparison processes, the endogenous formation of peer groups as well as their long-term consequences.

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Appendix – For Online Publication

A Additional material for performance-based preferences

Figure A.1 presents the distribution of the second and third most-preferred relative performance. We observe that these are also centered around the [0,1] second faster category but show some different pattern. Nonetheless, as reported in section 3.1, the differences in the distribution are due targeting the most-preferred relative performance. We thus restrict our attention to the first preference only.

Figure A.1: Distribution of second and third performance-based peer preferences

(a) Second performance-based preference (b) Third performance-based preference

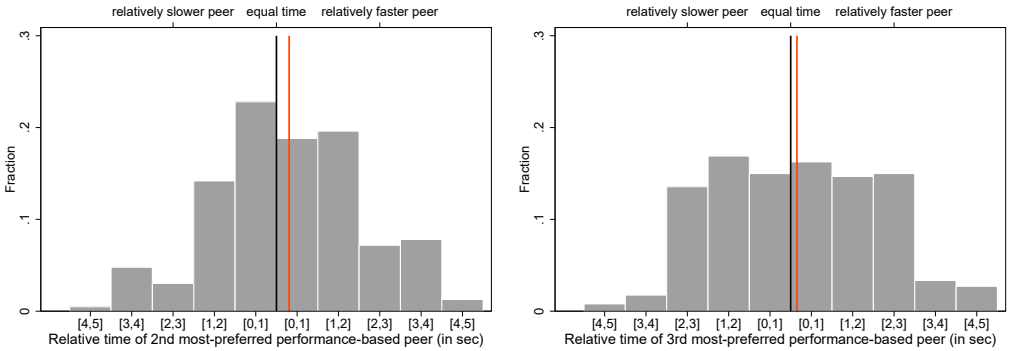
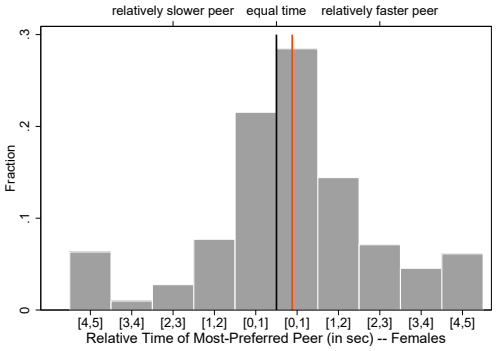


Figure (a) presents a histograms of students' preferences over relative performance. The intervals used here and in the survey are one-second intervals of relative performances in the first run. Vertical lines indicate own performances (black; equals zero by definition) and mean preference (red; where we used the mean of each interval to calculate the mean). Figure (b) presents the relationship of the first performance-based preference and the second/third preference.

In Figures A.2a and A.2b, we present gender splits of the most-preferred relative performance. While both distributions are relatively similar, males prefer somewhat faster peers than females. On average, females prefer peers being .38 seconds faster, whereas males prefer peers being .90 seconds faster. These correspond to 13 and 31% of a standard deviation in performances of the first run.

Figure A.2: Distribution of performance-based peer preferences by gender

(a) FEMALES



(b) MALES

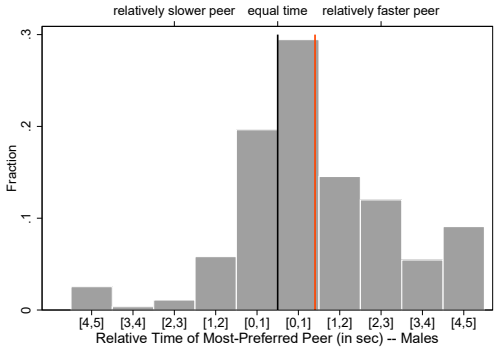


Figure (a) presents a histograms of students' preferences over relative performance. The intervals used here and in the survey are one-second intervals of relative performances in the first run. Vertical lines indicate own performance (black; equals zero by definition) and mean preference (red; where we used the mean of each interval to calculate the mean). Figure (b) presents the relationship of the first performance-based preference and the second/third preference.

B Additional material for peer selection analysis

This appendix provides descriptive statistics and robustness checks for the analysis of the peer selection process. Table B.1 provides summary statistics for the variables used in the analysis. In Table B.2 Panel A we consider someone to be nominated if he is nominated at all, i.e. among the first six most-preferred peers, and zero otherwise. Similarly, Panel (B) estimates a Tobit specification using all potential peers, where we only observe the ranking for six most-preferred peers and is censored otherwise. Table B.3 splits up the aggregate measure of personality and includes all dimensions separately. Table B.4 uses alternative definitions of friendship to show that our results are robust with respect to the exact definition. Finally, Table B.5 presents the heterogeneous effects for peer selection at the intensive margin.

Table B.1: Distribution of absolute differences

	Absolute differences				
	Mean	SD	25th perc.	50th perc.	75th perc.
Abs. Diff. in Time of First Run	2.55	2.10	0.93	2.06	3.59
Friendship Indicator	0.46	0.50	0.00	0.00	1.00
Abs. Diff. in Personality	3.99	1.12	3.20	3.92	4.66
Abs. Diff. in Agreeableness	1.13	0.85	0.44	0.96	1.65
Abs. Diff. in Conscientiousness	1.12	0.84	0.45	0.97	1.62
Abs. Diff. in Extraversion	1.13	0.84	0.45	0.95	1.66
Abs. Diff. in Openness	1.11	0.87	0.42	0.93	1.60
Abs. Diff. in Neuroticism	1.06	0.78	0.43	0.91	1.53
Abs. Diff. in Locus of Control	1.09	0.83	0.43	0.90	1.58
Abs. Diff. in Social Comparison	1.09	0.82	0.43	0.92	1.59
Abs. Diff. in Competitiveness	1.07	0.78	0.44	0.91	1.58
Abs. Diff. in Risk Preferences	1.12	0.87	0.45	0.90	1.79
For friends only					
Abs. Diff. in Time of First Run	2.33	1.95	0.84	1.87	3.25
Abs. Diff. in Personality	3.89	1.10	3.13	3.80	4.50

This table presents summary statistics for absolute differences in several characteristics. The upper panel considers all characteristics for the whole sample, while the lower panel restricts the characteristics to friends only.

Table B.2: Robustness checks: All nominated peers and censoring

	(A) Peer Nominated				(B) Peer Nomination Ranking
	(1)	(2)	(3)	(4)	(5)
Abs. Diff. in Time of First Run	-0.017***	-0.032***	-0.030***	-0.037***	-0.145***
	(0.004)	(0.006)	(0.009)	(0.009)	(0.042)
Friendship Indicator	0.495***	0.507***	0.515***		4.981***
	(0.022)	(0.024)	(0.049)		(0.311)
Abs. Diff. in Personality	-0.016***	-0.023***	-0.040***	-0.059***	-0.077*
	(0.005)	(0.007)	(0.009)	(0.017)	(0.044)
Abs. Diff. in Time of First Run × Abs. Diff. in Personality			0.002		
			(0.002)		
Abs. Diff. in Time of First Run × Friendship Indicator			-0.024***		
			(0.007)		
Abs. Diff. in Personality × Friendship Indicator			-0.016		
			(0.011)		
Controls for heterogeneity	Characteristics	Fixed effects	Fixed effects	Fixed effects	Fixed effects
Sample	All	All	All	Friends only	All
Observations	6654	6646	6646	2872	6654
Individuals	612	612	612	612	612
R^2	0.35	0.46	0.37	0.44	

Panel A presents the results from the extensive margin analysis using a linear probability model according to equation 1 with an indicator of being nominated as one of the sixth most-preferred name-based peers (i.e. whether a person is nominated as a peer at all) as the dependent variable. Column (4) restricts the sample to the set of friends. Panel B presents results of the intensive margin using the whole sample but allow for censoring of those classmates that were not nominated on the extensive margin. Standard errors are shown in parentheses and clustered at the class level. *, **, and *** denote significance at the 10, 5, and 1 percent level.

Table B.3: Robustness checks: Splitting up personality index

	(A) Peer Nominated	(B) Peer Nomination Ranking
	(1)	(2)
Abs. Diff. in Time of First Run	-0.029***	-0.173***
	(0.005)	(0.032)
Friendship Indicator	0.393***	1.716***
	(0.017)	(0.113)
Abs. Diff. in Agreeableness	-0.033***	-0.249***
	(0.009)	(0.054)
Abs. Diff. in Conscientiousness	-0.002	-0.054
	(0.008)	(0.053)
Abs. Diff. in Extraversion	-0.015	-0.104
	(0.010)	(0.063)
Abs. Diff. in Openness	-0.004	0.025
	(0.010)	(0.069)
Abs. Diff. in Neuroticism	-0.014	-0.141*
	(0.009)	(0.083)
Abs. Diff. in Locus of Control	-0.003	-0.056
	(0.009)	(0.079)
Abs. Diff. in Social Comparison	-0.022***	-0.163***
	(0.007)	(0.055)
Abs. Diff. in Competitiveness	-0.018*	-0.072
	(0.009)	(0.059)
Abs. Diff. in Risk Preferences	-0.005	0.006
	(0.009)	(0.086)
Controls for heterogeneity	Fixed effects	Fixed effects
Sample	All	All
Observations	6646	2756
Individuals	612	612
R^2	0.37	0.40

Panel A presents the results from the extensive margin analysis using a linear probability model according to equation 1 with an indicator of being nominated as one of the three most-preferred name-based peers as the dependent variable, but in which we allow for each personality measure to enter separately. Panel B presents analogous results of the intensive margin using the ranking among those who are nominated as peers. Standard errors are shown in parentheses and clustered at the class level. *, **, and *** denote significance at the 10, 5, and 1 percent level.

Table B.4: Robustness checks: Alternative definitions of friendship ties

	Peer Nominated		
	(1) Undirected	(2) Directed	(3) Reciprocal
Abs. Diff. in Time of First Run	-0.030***	-0.029***	-0.029***
	(0.005)	(0.005)	(0.005)
Abs. Diff. in Personality	-0.040***	-0.035***	-0.032***
	(0.009)	(0.008)	(0.007)
Friendship Indicator	0.392***	0.454***	0.507***
	(0.017)	(0.015)	(0.017)
Controls for heterogeneity	Fixed effects	Fixed effects	Fixed effects
Observations	6646	6646	6646
Individuals	612	612	612
R^2	0.37	0.41	0.42

This table presents the results from the extensive margin analysis using a linear probability model according to equation 1 with an indicator of being nominated as one of the three most-preferred name-based peers as the dependent variable for varying definitions of friendship ties. Column (1) uses undirected friendships as in the main text, column (2) defines friendship ties as directed, while column (3) only considers reciprocal links. Standard errors are shown in parentheses and clustered at the class level. *, **, and *** denote significance at the 10, 5, and 1 percent level.

Table B.5: Heterogeneities on the intensive margin of peer nominations

	Peer Nomination Ranking					
	(1) Males	(2) Females	(3) p-value	(4) Low Abil.	(5) High Abil.	(6) p-value
Abs. Diff. in Time of First Run	-0.162	-0.180***	0.884	-0.195***	-0.028	0.765
	(0.116)	(0.036)		(0.060)	(0.112)	
Friendship Indicator	1.441***	1.776***	0.234	2.174***	1.436***	0.012
	(0.245)	(0.134)		(0.140)	(0.202)	
Abs. Diff. in Personality	-0.486***	-0.200**	0.063	-0.204*	-0.304**	0.778
	(0.119)	(0.092)		(0.113)	(0.128)	
Controls for heterogeneity	Fixed effects	Fixed effects		Fixed effects	Fixed effects	
Observations	777	1979		1260	1230	
Individuals	207	405		308	301	
R^2	0.46	0.38		0.51	0.50	

This table replicates Panel B of Table 3 for different sub-samples. More specifically, it presents results from the intensive margin analysis using the ranking among those who are nominated as peers, in which better rankings correspond to higher values of the dependent variable (6: highest, 1: lowest). Standard errors are shown in parentheses and clustered at the class level. *, **, and *** denote significance at the 10, 5, and 1 percent level.

C Relationship of beliefs and actual performance

In this section, we first describe the relationship between beliefs and actual performance. Afterwards, we provide evidence that the beliefs are meaningful, which is consistent over time by leveraging a second measurement of the same belief.

Beliefs over relative performance and actual relative performance do not necessarily coincide. We therefore check how these two relate to each other. Figure C.1a presents a scatter plot of the belief over relative performance of name-based peers and their actual relative performance. We observe that although the relationship is not perfect, these two are significantly related as is confirmed by the corresponding regressions in Table C.1. Figure C.1b displays the absolute differences between the beliefs and the actual relative performance. On average, these two have an absolute difference of 1.95 seconds.

Figure C.1: Relationship of beliefs and actual performance

(a) Relationship (b) Absolute difference

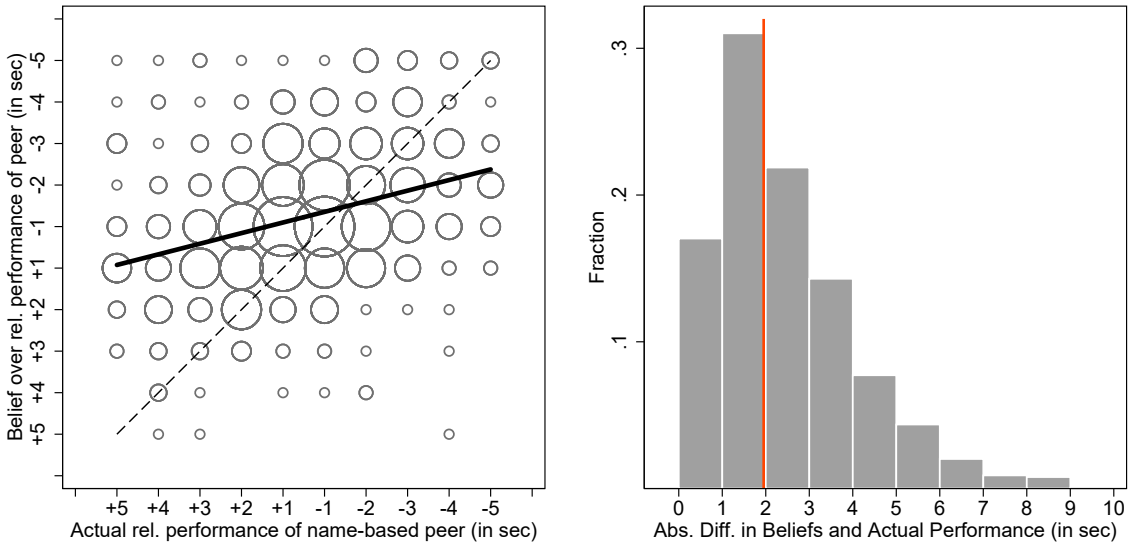


Figure (a) presents the relationship beliefs over and actual relative performance of the name-based peers. The corresponding regression is presented in Table C.1. Figure (b) presents a histogram of the absolute difference in beliefs and actual performance. The vertical line in (b) indicates mean absolute difference (red; where we used the mean of each interval to calculate the mean). The intervals used here and in the survey are one-second intervals of relative performances in the first run.

Table C.1: Relationship between beliefs over and actual relative performance

	(a) Peer's relative time		(b) Peer is faster (binary)	
	(1)	(2)	(3)	(4)
Relative Time of most-preferred name-based peer	0.25***	0.24***		
	(0.04)	(0.04)		
Preferred name-based peer is faster			0.27***	0.25***
			(0.05)	(0.05)
Personality	No	Yes	No	Yes
Class FEs, Gender, Age	Yes	Yes	Yes	Yes
N	566	562	566	562
R^2	.21	.23	.16	.17

This table presents least squares regressions using a peer's relative performance according to the beliefs of the name-based preferences as the dependent variable. Figure C.1 presents the results graphically. Standard errors are shown in parentheses and clustered at the class level. *, **, and *** denote significance at the 10, 5, and 1 percent level.

Moreover, we are interested whether the beliefs capture pure noise or whether they are constant over time. To check for consistency of the beliefs, we lever a second (binary) belief elicited right before the second run and compare it to the beliefs elicited as part of the name-based preferences. The first two columns of Table C.2 use the continuous measure of beliefs over relative performance as elicited in the name-based preferences as the dependent variable. The second set of columns uses a binary version of this indicating whether the student believed that the peer has been faster or slower. The sample is restricted to those students with peers that are nominated somewhere in the name-based preferences (i.e., for whom we have beliefs) and that are matched as a peer in the second run (i.e., only for those for whom we have a second belief measure). This naturally oversampled observations in NAME. We thus check whether the pattern differs depending on the treatment. As can be seen, the two measures are significantly related with a correlation of .58. Moreover, this correlation does not significantly vary with the assigned treatment.

Table C.2: Consistency of beliefs

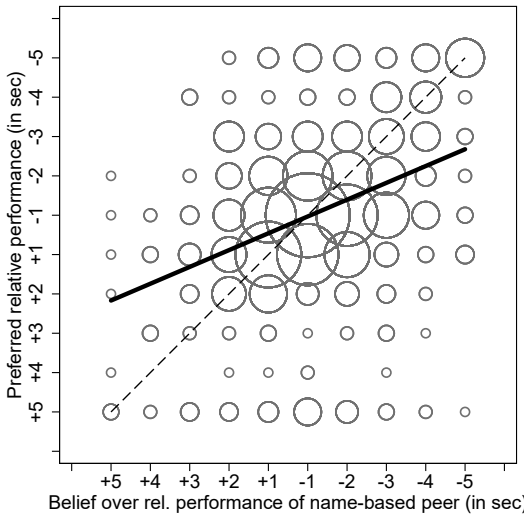
	(a) Continuous belief		(b) Binary belief	
	(1)	(2)	(3)	(4)
Believe peer is faster	1.96***		0.58***	
	(0.23)		(0.05)	
RANDOM × Believe peer is faster		2.00***		0.53***
		(0.27)		(0.06)
NAME × Believe peer is faster		1.92***		0.59***
		(0.23)		(0.05)
PERFORMANCE × Believe peer is faster		2.01***		0.58***
		(0.23)		(0.05)
N	345	345	345	345
R^2	.26	.27	.3	.31

This table presents least squares regressions using the beliefs over the peer's performance as elicited in the name-based preferences as the dependent variable. The sample is restricted to those subjects with peers that are nominated in the name-based preferences and are actually matched for the second run, for which we have elicited a second (binary) belief measure. 89 observations are from students in RANDOM, 180 from NAME, and 87 from PERFORMANCE. Standard errors are shown in parentheses and clustered at the class level. *, **, and *** denote significance at the 10, 5, and 1 percent level.

D Additional material for relationship of preferences

Figure D.1 and Table D.1 provide a first view on the relation of performance- and name-based preferences. More specifically, we associate preferred relative performances of each individual with beliefs over the relative performance of their peers nominated in the name-based preferences. We observe a positive relationship between the two measures as shown in Figure D.1.

Figure D.1: Relationship of performance- and name-based preferences for peers



The figures present the relationship between performance- and name-based preferences using beliefs over peer's performance. Corresponding regressions are presented in Table D.1.

Table D.1 quantifies this relationship: if students select a peer who they believe is one second faster, this is associated with an increase in the relative performance in the performance-based preference by .44 seconds on average (columns (1) and (2)). Similarly, we observe a significant positive relationship between binary indicators of believing that the most-preferred name-based peer is faster and choosing a faster peer in the performance-based preference in columns (3) and (4). Nonetheless, the relationship between name- and performance-based preferences is not perfect, as it would be the case if the preferences over relative performance were the only determinants of name-based preferences. If this were the case, we should observe regression coefficients of unity.

Table D.1: Relationship between preferences based on names and relative performance

	Peer preference over rel. perf.			
	(a) Continuous		(b) Binary	
	(1)	(2)	(3)	(4)
Belief over peer's rel. perf.	0.44***	0.44***	0.29***	0.29***
	(0.06)	(0.06)	(0.04)	(0.04)
Personality	No	Yes	No	Yes
Class FEs, Gender, Age	Yes	Yes	Yes	Yes
Individuals	627	623	582	578
R^2	.25	.28	.17	.2

This table presents least squares regressions using a peer's relative performance in one-second intervals or an indicator for preferring a faster peer according to the performance-based preferences as the dependent variable. Standard errors are shown in parentheses and clustered at the class level. *, **, and *** denote significance at the 10, 5, and 1 percent level. Figure D.1 presents the results graphically.

One potential explanation for the imperfect relationship between performance- and name-based preferences is measurement error. Here, we show that measurement error is unlikely to explain the imperfect association alone. Assume that we have classical measurement error and the true coefficient corresponds to one ($\beta = 1$), then by the standard attenuation bias formula (Cameron and Trivedi, 2005, p. 903f.), we have that if $x^* = x + v$ with v being a mean-zero error with variance σ_v^2,

$$p\lim \hat{\beta} = \frac{\sigma_{x^*}^2}{\sigma_{x^*}^2 + \sigma_v^2}\beta = \lambda\beta = \lambda \tag{2}$$

as $\beta = 1$ and where λ is the attenuation factor.[1] Thus the regression coefficients in Table D.2 correspond to the attenuation factors that would be needed for a perfect relationship. For a more intuitive interpretation, we rewrite the factor in terms of the noise-to-signal ratio s such that $\lambda = 1/(1+s)$. The noise-to-signal ratio tells us how much noise relative to signals the data should have if the true relationship is given by $\beta = 1$. We reproduce Table D.1 here and additionally present the corresponding noise-to-signal ratios of each coefficient below the corre-

[1] For the multivariate case the formula is slightly different, but the basic idea remains the same.

sponding regressions. We find that all ratios exceed one, which implies that the measurements would need to have more noise components than actual information. We thus conclude that measurement error alone cannot explain the imperfect relationship.

Table D.2: Relationship between performance- and name-based preferences

	(a) Peer's relative time		(b) Peer is faster (binary)	
	(1)	(2)	(3)	(4)
Panel A: Using name-based beliefs				
Belief over name-based peer's performance	0.44***	0.44***		
	(0.06)	(0.06)		
Belief over name-based peer's performance (0/1)			0.29***	0.29***
			(0.04)	(0.04)
Personality	No	Yes	No	Yes
Class FEs, Gender, Age	Yes	Yes	Yes	Yes
N	627	623	627	623
R^2	.25	.27	.17	.2
Noise-to-Signal Ratio needed for $\beta = 1$	1.3	1.3	2.5	2.5
Panel B: Using name-based actual performance				
Relative Time of most-preferred name-based peer	0.10***	0.09***		
	(0.03)	(0.03)		
Preferred name-based peer is faster			0.04	0.03
			(0.04)	(0.04)
Personality	No	Yes	No	Yes
Class FEs, Gender, Age	Yes	Yes	Yes	Yes
N	566	562	566	562
R^2	.11	.13	.095	.12
Noise-to-Signal Ratio needed for $\beta = 1$	9.2	10	26	28

This table presents least squares regressions using a peer's relative performance in one-second intervals or an indicator for preferring a faster peer according to the performance-based preferences as the dependent variable. Standard errors are shown in parentheses and clustered at the class level. *, **, and *** denote significance at the 10, 5, and 1 percent level. The reported signal-to-noise ratio describes the extend of measurement error needed if the true relationship is actually perfect (i.e., $\beta = 1$) rather than imperfect ($\beta < 1$). Accordingly, a noise-to-signal ratio larger than one indicates more noise than signal, equal to one corresponds to as much signal as noise and less than one more signal than noise. Figure D.1 presents the results graphically.

Table D.3: Robustness checks: Splitting up personality index

	(A) Peer Nominated	(B) Peer Nomination Ranking
	(1)	(2)
Abs. Diff. in Time of First Run	-0.011*	-0.052
	(0.006)	(0.045)
Abs. Diff. from Perf.-based Preference	-0.022***	-0.145***
	(0.006)	(0.042)
Friendship Indicator	0.394***	1.711***
	(0.017)	(0.114)
Abs. Diff. in Agreeableness	-0.034***	-0.242***
	(0.009)	(0.057)
Abs. Diff. in Conscientiousness	-0.002	-0.055
	(0.008)	(0.052)
Abs. Diff. in Extraversion	-0.015	-0.103
	(0.010)	(0.063)
Abs. Diff. in Openness	-0.003	0.033
	(0.010)	(0.069)
Abs. Diff. in Neuroticism	-0.014	-0.136
	(0.009)	(0.082)
Abs. Diff. in Locus of Control	-0.003	-0.055
	(0.009)	(0.078)
Abs. Diff. in Social Comparison	-0.021***	-0.161***
	(0.007)	(0.054)
Abs. Diff. in Competitiveness	-0.018*	-0.072
	(0.010)	(0.057)
Abs. Diff. in Risk Preferences	-0.005	-0.006
	(0.009)	(0.085)
Controls for heterogeneity	Fixed effects	Fixed effects
Sample	All	All
Observations	6646	2756
Individuals	612	612
R^2	0.37	0.41

Panel A presents the results from the extensive margin analysis using a linear probability model according equation 1 with an indicator of being nominated as one of the three most-preferred name-based peers as the dependent variable, but in which we allow for each personality measure to enter separately and add absolute deviations of the most-preferred relative performance as an additional regressor. Panel B presents analogous results of the intensive margin using the ranking among those who are nominated as peers. Standard errors are shown in parentheses and clustered at the class level. *, **, and *** denote significance at the 10, 5, and 1 percent level.