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Ethnic Diversity and Team Performance: A Field Experiment*

Sander Hoogendoorn Mirjam van Praag

Abstract

One of the most salient and relevant dimensions of team heterogeneity is ethnicity. We measure the impact of ethnic diversity on the performance of business teams using a field experiment. We follow 550 students who set up 45 real companies as part of their curriculum in an international business program in the Netherlands. We exploit the fact that companies are set up in realistic though similar circumstances and that we, as outside researchers, had the unique opportunity to exogenously vary the ethnic composition of otherwise randomly composed teams. The student population consists of 55% students with a non-Dutch ethnicity from 53 different countries of origin, enabling us to include extremely diverse teams in our study. We find that a moderate level of ethnic diversity has no effect on team performance in terms of business outcomes (sales, profits and profits per share). However, if at least the majority of team members is ethnically diverse then more ethnic diversity seems to affect the performance of teams positively. Our data suggest that this positive effect might be related to the more diverse pool of relevant knowledge facilitating (mutual) learning within ethnically diverse teams.

JEL-codes: J15, L25, C93, L26, M13, D83; Keywords: ethnic diversity, team performance, field experiment, entrepreneurship, (mutual) learning

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1 Introduction

> It is impossible to pick up a business publication these days without reading about the wonders of teamwork. [...] Once teamwork is accepted as a basic business principle, it is not much of a stretch to think about teams that are comprised of diverse individuals, coming from different countries and cultures (Lazear, 1999, p. 15).

We measure the effect of team composition in terms of ethnic diversity on the performance of business teams using a field experiment. The choice for this topic and approach are easily motivated. Teams have become increasingly important as decision making bodies. This is the case in many sorts of organizations, varying from judges in collegial courts or academic researchers to business start-ups (Hamilton et al., 2003). Consequently, the effective composition or diversity of teams has become an interesting topic of research (Hoogendoorn et al., 2013; Prat, 2002).[1]

One of the most salient dimensions of team heterogeneity is ethnicity (Alesina and La Ferrara, 2005). Ethnic diversity implies heterogeneity in (mother) languages, religions, races and cultures (Alesina and La Ferrara, 2005). It is commonly measured based on country of birth, of the individual or of his/her parents. Ethnic diversity also coincides with a variety of norms, information sets, knowledge and ability levels (Lazear, 1999; Morgan and Vardy, 2009). This variety affects the formation and performance of teams. Ethnic diversity would benefit team performance due to a more diverse pool of skills and knowledge that leads to complementaries and (mutual) learning. For example, due to complementarities and learning opportunities, ethnically diverse teams are associated with more creativity and innovation (Alesina and La Ferrara, 2005; Lee and Nathan, 2011; Ozgen et al., 2011b). On the other hand, the costs associated with more ethnic diversity would be related to more difficult communication and coordination (Lazear, 1999; Morgan and Vardy, 2009).[2] All in all, ethnic diversity is an influential source of heterogeneity.

[1] This is the second paper on a 'double' experiment that we conducted. In this experiment, we randomized students into teams based on two dimensions: ethnicity and gender. Combining these two dimensions is unproblematic because gender diversity and ethnic diversity are orthogonal. See for the gender study Hoogendoorn et al. (2013).

[2] Ethnic diversity may also affect group formation and performance through its influence on the group

Ethnic diversity is highly relevant in an increasingly globalized world. Multinational firms often staff teams internationally and local populations - especially in big cities - become more mixed and multicultural. Ethnic diversity is a current fact of life and the share of ethnic minorities in Western populations is increasing sharply (Alesina and La Ferrara, 2005; Lazear, 1999; Ozgen et al., 2011b). In the United States, for example, the share of minorities is expected to rise from about one-third nowadays to roughly the majority in 2042 (Bernstein and Edwards, 2008). As a consequence, it is likely that any team will become more and more diverse in terms of ethnicity, even if the optimal team formation would indicate otherwise.

The relevance and potential impact of ethnic diversity in teams motivate our choice for the topic of this study. Our approach of a field experiment among business teams that start up in identical circumstances is motivated as follows. Team formation is obviously driven by prospective productive consequences. If the situation carries a higher likelihood that an ethnically diverse team is beneficial, the team composition will be more mixed (Boisjoly et al., 2006). Hence, the measured effects of ethnic diversity on performance in real-world teams are likely to be biased due to endogenous team composition. Examples of studies conducted on the ethnic diversity of teams in real organizations include Carter et al. (2010), Hamilton et al. (2012), Kahane et al. (2013), Leonard et al. (2010) and Parrotta et al. (2010), and their results are ambiguous (Alesina and La Ferrara, 2005).[3]

Laboratory experiments do not suffer from endogenous team composition. Experiments in the lab have established results that are largely consistent with the theory proposed by Lazear (1999): an optimal degree of heterogeneity is determined by the trade-off between the benefits of more ethnic diversity and the associated increased costs of communication and coordination (Alesina and La Ferrara, 2005). The downside of laboratory studies is that their resemblance to real-world situations may be limited. They typically measure short-term effects, whereas the consequences of a team's diversity in terms of, for example, coordination and communication or complementarities and learning are not likely to be-

culture (Earley and Mosakowski, 2000; Richard et al., 2004) and the strategic behavior of group members (Alesina and La Ferrara, 2005).

[3]Other studies examine the effects of ethnic diversity on productivity at the country (Guiso et al., 2009; Montalvo and Reynal-Querol, 2005), region (Ozgen et al., 2011a) or city level (Lee and Nathan, 2011; Ottaviano and Peri, 2006). Related are also studies measuring the impact of ethnic composition of schools or neighborhoods on educational outcomes (e.g., Angrist and Lang, 2004; Aslund et al., 2011; Card and Rothstein, 2007; Hanushek et al., 2009; Hoxby, 2000).

come evident instantaneously (Boisjoly et al., 2006). It is thus useful to study the effects of team composition in the longer run and preferably in more realistic circumstances.

Some studies measuring the effect of ethnic diversity have combined the advantages of studies in real organizations with experimental studies by carrying out field or 'quasi' experiments. Hansen et al. (2006) resemble the design of a field experiment. They measure the impact of demographic diversity (age, gender and ethnicity) in student groups of four to five students on the team's academic performance and find no effect.[4] Boisjoly et al. (2006) find that attitudes and behaviors change when people of different ethnicity are randomly assigned to live together at the start of their first year of college. White students assigned to African-American roommates show to be significantly more empathetic to these groups.

We conclude that measurements of the causal effect of a team's ethnic diversity on its performance are scarce, especially in the longer run. This kind of measurement is the objective of our study. To this end, we conducted a field experiment in the context of a compulsory entrepreneurship program for undergraduate students in international business at the Amsterdam University of Applied Sciences. We follow 550 students who set up and manage 45 real companies as part of their curriculum in the academic year of 2008-2009. We exploit the fact that the - otherwise homogeneous - population consists of 55% students with a non-Dutch ethnicity from 53 different countries of origin and that we, as outside researchers, were allowed to exogenously vary the ethnic composition of otherwise randomly composed teams. The resulting percentage of students with a non-Dutch ethnicity per team varies from 20% to 90%. We use a rather common definition of ethnicity, i.e., parents' country of birth.

Our field experiment implies a level of controlled circumstances comparable to the laboratory. All teams start up companies simultaneously and under equal circumstances and all members are selected from a pool of students, minority or Dutch, of the same caliber. The substantial variation (20-90%) enables us to capture possible non-linearities in the relationship between ethnic diversity and team performance. Moreover, this creates the novel opportunity to study teams in which the majority of its members is diverse.

[4]Group composition is random and no exogenous stratification is imposed. Teams are required to select one of three contract forms that determine the authority of grading. The drawback of this design, when interested in the bare effect of ethnic diversity on team performance, is that the effect of interest may be confounded by the contract choice (that may be related to ethnic diversity).

Currently, this circumstance is not yet realistic. However, this is rapidly changing.

At the same time, the entrepreneurship program and the truly joint task with strong incentives to maximize sales, profits and shareholder value of a company in a real market resemble realistic circumstances that are not likely to be mimicable in a laboratory setting. In particular, these circumstances give rise to the formation of a real team in which people have time to establish roles and observations of other team members.

What kind of results might we expect? We combine Lazear's argument (1999) that there is a trade-off between the costs and benefits of an ethnically more diverse team with recent insights from Earley and Mosakowski (2000) and Richard et al. (2004) based on Blau's theory of heterogeneity (1977). The non-formal models in these studies refine Lazear's argument by allowing the costs of communication and coordination to be a non-linear function of ethnic diversity. Moderately heterogeneous teams would incur higher costs of communication and coordination than teams that are homogeneous or heterogeneous in terms of ethnicity. In these moderately heterogeneous teams subgrouping along ethnic lines may have negative effects such as distrust, conflicts or stereotyping between distinct subgroups.[5]

The non-linear relationship between communication costs and ethnic diversity could perhaps be illustrated by considering three types of team compositions: (i) with a low percentage of minorities, (ii) with a substantial subgroup of minorities, and (iii) with a majority group of minorities. In the first situation, the communication costs are probably low. The few minorities present will perhaps not participate in the team process and be left aside. This is costly in the sense that their productivity is lost, but communication can be low cost too and based on habits, language and norms of the majority group (i.e., with a single identity). In the second situation, the group that may not take part in the productive process of the majority is larger. Segregated subgroups may be formed by the majority and the others with distinct manners of work. Hence, the costs of diversity are higher at this stage. In the third situation, in a truly ethnically diverse team, the

[5] Akerlof and Kranton (2005) show that teams' identity could act as a substitute mechanism for formal incentive schemes. In a series of laboratory experiments, Charness et al. (2007) find that group membership and identification with this group, influence individual behavior in strategic environments. Moreover, individuals tend to operate significantly more altruistically towards ingroup members than to outgroup individuals (Chen and Li, 2009). In a field experimental setting, Dugar and Shahriar (2012) find that group identity can reduce moral hazard problems.

costs of communication have probably become lower due to the absence of subgroups and the desirability for every team member to participate in a hybrid team culture with a diverse identity (Earley and Mosakowski, 2000; Richard et al., 2004). We thus expect that the costs of ethnic diversity follow an inverse u-shaped pattern, whereas the benefits of complementarities and (mutual) learning may be an(y) increasing function of ethnic diversity (Lazear, 1999).

Due to the fact that we do not have any conjectures about the specific forms of the cost and benefit functions relative to each other, the net effect of ethnic diversity on team performance remains a question that needs to be answered empirically. If anything, the net benefits are expected to start increasing after a certain threshold. Before that threshold has been reached, minorities, as a small part of the team, tend to be 'marginalized' or form a different group, but such marginalization tends to disappear when the share of minorities is sufficiently large.

Our empirical analysis shows the following results. The impact of a team's ethnic diversity on its performance as measured in terms of business outcomes is flat or slightly negative but seems to turn positive when the team starts to be truly heterogeneous, i.e., when the majority of the team is ethnically diverse. The flat or slightly negative effect that we find for the part of the distribution where ethnic diversity is not so high is consistent with earlier findings, all based on samples including a limited range of the distribution of diversity (Carter et al., 2010; Hamilton et al., 2012; Kahane et al., 2013; Leonard et al., 2010; Parrotta et al., 2010). The positive effect of more diversity on business performance when the majority of the team has ethnically diverse backgrounds is a novel finding and this novelty is possibly due to the fact that we have been the first to study the very right handside of the distribution of ethnic diversity.

Altogether, these results are consistent with the expectations based on narrative theories, discussed before. They suggest that there is a tipping point: "the moment of critical mass, the threshold, the boiling point" (Gladwell, 2000, p.12; see also Card et al., 2008). Here, the marginalization of minority team members tends to disappear and a truly hybrid team culture may have been achieved. With respect to underlying mechanisms, our data are consistent with the idea that more ethnically diverse teams tend to have a more diverse pool of relevant knowledge facilitating more (mutual) learning that may lead to

better business results. However, please note that we, like other studies, can only provide suggestions why ethnically diverse teams might perform differently since all the potential underlying mechanisms that we explore, such as learning, are endogenous.

In what follows, Section 2 provides information on the context and design of the field experiment. The context and design, and therefore parts of these descriptions, are similar to the field experiment described in Hoogendoorn et al. (2013). Section 3 describes the data and presents results from randomization checks. Section 4 shows the empirical findings. Section 5 provides a discussion and conclusion.

2 Context and design

2.1 Context

The teams in our field experiment take part in the Junior Achievement (JA) Young Enterprise Start Up Program, in the US known as the JA Company Program. This is the worldwide leading entrepreneurship program in secondary education (US and Europe) and post-secondary education (only Europe). The number of students participating in these JA-programs is substantial and steadily rises over the years (see Oosterbeek et al., 2010).

The entrepreneurship program that we study is a compulsory part of the curriculum at the department of international business studies of the Amsterdam College of Applied Sciences. It lasts for an entire academic year and covers about one-fifth of students' first-year undergraduate curriculum in all sub-departments/fields of study.[6] Our field experiment was conducted in the academic year of 2008-2009. The program is not a business simulation and requires students to set up and manage a real company with a team of about 10 to 12 fellow students on average. Students issue shares, appoint officers and delegate tasks, produce and market products or services, keep the accounts and organize shareholders' meetings. Students thus frequently interact, build up relationships, and create routines and processes to achieve their common goal. In addition, each company is supported by a coach from the business world. Throughout the program the teams report to their randomly assigned professor and business coach on a regular basis. The companies

[6]The international business program at the Amsterdam College of Applied Sciences is divided into five sub-departments/fields of study: business management, management, trade management Asia, business languages and financial management.

also pay taxes and social security payments.

Companies typically operate as follows. They start with appointing an interim CEO. Teams then elect officers and delegate tasks among their members. About half of the team works in non-management positions and the other half holds specific management positions including the CEO and CFO. After half a year the management positions are redistributed among the formerly non-managing part of the team.[7] Right from the beginning teams also start to brainstorm about possible products or services, where promising business ideas are further analyzed by conducting market research. Subsequently, the most viable business idea is selected and developed (there are no restrictions in selecting the type of business activity). Once the corporate plan has been finished, teams start to raise capital and organize a shareholders' meeting. Other sources of funding such as personal or outside loans were prohibited. Business operations start as soon as the majority of shareholders approves the corporate plan. Production and marketing of products or services then become the key activities. At the end of the program all companies are liquidated and teams present their annual report for approval at the final shareholders' meeting. Any profits are proportionally divided among the shareholders. Table 1 lists team characteristics such as their ethnic composition, size, business performance and product or service.

Ethnicity

Students are defined as native or Dutch if both parents are born in the Netherlands, whereas students are considered immigrant, minority or non-Dutch if at least one parent is not born in the Netherlands (see Hartog, 2011). The share of students in our sample with a non-Dutch ethnicity is 0.55 and the percentage of students with a non-Dutch ethnicity varies per team from 20% to 90%.[8] We measure ethnic diversity dichotomously. This is consistent with previous empirical studies (Boisjoly et al., 2006; Carter et al., 2010; Hamilton et al., 2012; Hansen et al., 2006) as well as with our assignment of students

[7]The relationship between the ethnic composition of teams and their allocation of roles across ethnicities is discussed below.

[8]The average share of minorities in Dutch higher vocational schools is approximately 0.20, which is close to the population average (Hartog, 2011). The considerably higher share here reflects the international character of this program in the multicultural capital of Amsterdam.

Table 1. Team characteristics

#	Name	Share of minorities	Team size	Sales (euros)	Profits (euros)	Profits/ share	Description of product/service
1	A-Card	0.50	16	1236	-848	-11.78	Discount card Amsterdam nightlife
2	A'dam Gadgets	0.45	12	534	-41	-0.47	USB hot plate for coffee, tea, etc.
3	Appie	0.40	11	455	150	3.00	Apple-shaped box to preserve apples
4	Aqua de Coctail	0.58	12	1130	-306	-3.12	Comprehensive cocktail shaker set
5	ArtEco Bags	0.60	11	912	-402	-7.44	Durable give-away bag clothes stores
6	BubbleMania	0.70	11	503	-62	-1.34	Multi-purpose protective key chain
7	D'Wine	0.63	9	740	-55	-1.62	Bottles of wine
8	Eastern Green	0.69	14	513	106	2.93	Engravable text bean growing a plant
9	Escapade Inc	0.22	9	593	-111	-3.09	Tube clip for sealing food, toiletry, etc.
10	eyeBMA	0.50	16	558	125	3.90	Package with easy-to-use eye shadow
11	Firefly	0.20	12	2226	294	3.67	Ascending fire lantern for celebrations
12	Fl!pthat	0.64	13	455	215	9.77	Redecorating already existing websites
13	Ginger	0.58	12	977	-107	-2.14	Multi-purpose solar energy charger
14	Himitsu	0.86	10	775	36	0.86	n/a
15	I-Care	0.54	15	1204	477	11.36	Dead Sea minerals beauty products
16	iJoy	0.64	14	1953	94	1.44	Wristband with USB capacity
17	I-Juice	0.54	13	1255	-39	-0.42	Pocket-size lightweight mobile charger
18	IMSC	0.55	11	625	-390	-7.41	n/a
19	iShield	0.50	11	4209	130	2.20	Invisible protective shield for iPhones
20	KISBag	0.57	9	205	-117	-3.90	Tiny foldable bag replacing plastic bags
21	Laservibes	0.40	11	130	-229	-4.32	Organizing lasershows for companies
22	Mengelmoes	0.71	10	942	63	1.24	Easy-to-wear telephone charger device
23	My-Buddy	0.45	12	297	-58	-2.65	USB doll for kids reflecting emoticons
24	Nine2Five	0.60	12	235	-1016	-12.87	USB hot plate for coffee, tea, etc.
25	Picture Perfect	0.54	15	260	-51	-1.45	Customized shirts for men and women
26	Pietje Plu	0.40	12	n/a	n/a	n/a	Trendy umbrellas
27	Pocket Memory	0.73	16	979	103	1.20	Business cards with USB capacity
28	Pro'Lux	0.54	14	378	-395	-9.18	Promotional gifts with USB capacity
29	Qwinlok	0.42	13	340	35	0.91	Boxer shorts for female adolescents
30	Reflection	0.36	11	890	45	0.84	Cosmetics mirror incl. mascara clip
31	SAME	0.36	11	1618	152	2.15	Comfortable unisex earwarmer
32	Sappho	0.50	8	980	n/a	n/a	n/a
33	Sharity	0.67	12	265	-241	-8.04	Peace sign necklace for teenagers
34	ShoeTattoo	0.77	13	270	88	1.21	Shoe customization by graphic artists
35	Student Promotion	0.42	13	571	235	15.64	Promotional activities for companies
36	StuPill	0.31	14	731	-1011	-15.48	Convenient Indonesian anti-RSI pillow
37	Test-a-Holic	0.45	11	728	220	4.88	Alcohol breath tester for nightlife
38	We-Do Solutions	0.56	10	604	-267	-6.06	Multi-purpose trendy key chain
39	We 'R U	0.33	13	1041	50	0.89	Compact wallet in several colors
40	XNG	0.90	12	1088	258	7.60	Shirts 'Chicks on Kicks' community
41	YEN Empowered	0.83	13	1267	33	0.71	n/a
42	YET's Wear	0.79	16	789	-247	-2.47	Customized shirts own YET-brand
43	YOU	0.64	12	0	-242	-6.55	Hotel door hanger to store keys, etc.
44	Young Legends	0.67	9	400	59	0.84	n/a
45	YUVA	0.70	16	1153	294	12.79	Engravable rice grain in glass covering

Note: Share of minorities is based on a dummy indicator for students of Dutch and non-Dutch ethnicity (excluding students whose ethnicity is unknown). The number of students whose ethnicity is unknown amounts to 52 (out of 550 students). Team size reflects the size of teams at baseline. Missing or incomplete descriptions of a team's product or service are indicated by 'n/a' (not available).

to teams.[9] We do not use any other more refined measures of ethnical background by distinguishing *degrees* or *kinds* of minorities such as country of birth, degree of integration, language or religion. Students with a non-Dutch ethnicity are born abroad in 38% of the cases, with 82% of the fathers born abroad and 87% of the mothers. In 69% of the cases both the father and the mother are born abroad.

Table 2 shows that the students in our sample are from 53 different countries of origin with an average number of approximately 6 different countries of origin per team (panel A). Only for the purpose of presentation, the descriptive statistics in panel B are collapsed into groups (see Parrotta et al., 2010). They indicate that ethnic variation among minority students is substantial. Panel C shows that there are virtually no clusters of ethnic minorities on the team level. The vast majority of ethnic minority students has no team members from the same country of origin (70%), whereas 19% of the ethnic minority students has only one team member from the same country of origin (the average number of students with a non-Dutch ethnicity per team is 6.8 at baseline). Hence, we can safely assume that the share of students with a non-Dutch ethnicity is a true indicator of the team's ethnic diversity.[10] This varies exogenously and substantively. Moreover, the average and range of the share of minorities are similar across fields of study (panel D). We will test for possible pretreatment differences more formally below.

2.2 Design

One week before the start of the entrepreneurship program the school provided administrative data that we used for assigning students to teams. The ethnicity of students was determined based on students' names, Dutch versus non-Dutch (see Mateos, 2007 for a

[9] An alternative way of measuring ethnic diversity takes the country of (parental) origin into account and is expressed in terms of Blau's diversity index (1977), $1 - \sum_{i=1}^{N} p_i^2$. Here, p is the share of individuals in a (ethnic) category i and N the number of (ethnic) categories. Disadvantages of Blau's diversity index are that it: (i) implicitly assumes that each category is different from another *to the same extent* and (ii) turns out rather sensitive to the number of (ethnic) categories in the sample. The upside, though, may be that it takes into account that diversity is larger when individuals originate from all distinct countries than when they or their parents are all born in the same foreign country. However, our initial assignment of students to teams and, hence, the exogenous variation in teams' diversity is based on the dichotomous measure of ethnicity. As a consequence, we can only use that measure convincingly to study the causal effect of ethnic diversity on team performance.

[10] Only two teams form an exception: one accommodates six and the other four members from the same country of origin. Excluding these two teams from the sample does not change the main results. Robustness checks indicate that our findings also remain similar when we control for the number of different countries of origin.

Table 2. Descriptive statistics of ethnic diversity

A: Ethnicity (team level)	Mean	SD	Min	Max
Share of minorities	0.55	0.16	0.20	0.90
Number of different countries of origin	6.04	1.82	3.00	12.00

B: Ethnicity (collapsed into groups)	Fraction
Netherlands (native)	0.45
North America / Oceania	0.01
Central and South America	0.15
Formerly Communist Countries	0.02
Mediterranean Countries	0.17
East Asia	0.06
Asia	0.04
Africa	0.03
Other European Countries	0.07

C: Ethnic minority students with number of team members from the same country of origin	Fraction
0	0.70
1	0.19
2	0.05
$\geqslant 3$	0.06

D: Numbers of students and teams, and share of minorities by field of study	Students	Teams	Share of minorities (per team)		
			Average	Minimum	Maximum
Business management	240	18	0.52	0.20	0.79
Management	60	5	0.54	0.31	0.64
Trade management Asia	105	9	0.66	0.42	0.90
Business languages	118	11	0.50	0.22	0.77
Financial management	27	2	0.66	0.58	0.73
Total	550	45	0.55	0.20	0.90

Note: Ethnic minority students are from the following countries of origin: Afghanistan, Algeria, Angola, Antilles, Argentina, Australia, Barbados, Brazil, Cameroon, Canada, Cape Verde, China, Colombia, Costa Rica, Cuba, Dominican Republic, Egypt, Eritrea, Gabon, Germany and other Western European countries, Ghana, Guinea, Guyana, Honduras, Hong Kong, India, Indonesia, Iran, Iraq, Israel, Jamaica, Japan, Kenya, Laos, Malaysia, Morocco, Nigeria, Pakistan, Palestine, Peru, Philippines, Russia and other Eastern European countries, Singapore, Somalia, South Africa, Surinam, Tunisia, Turkey, United States and Vietnam.

motivation of this name-based procedure). Nearly 90 percent of these name-based classifications matched with students' actual ethnicity that we retrieved through a pretreatment survey one week later. As expected, most of the mismatches in the category of ethnic minority students occured among those with Dutch fathers.

Subsequently, we determined and varied the fraction of ethnic minority students for each team within fields of study and assigned students with Dutch and non-Dutch ethnicity randomly to teams in accordance with these fractions. The program coordinators enforced this assignment successfully (only 6 students managed to switch teams during the year). Students and business coaches were uninformed, while professors only knew that a research project was conducted which required to stick to the imposed team assignment. Interviews with students corroborate their ignorance regarding our field experiment.

Composition dynamics

Composition dynamics such as dropouts during the entrepreneurship program or the appointment of students to management teams may compromise the design of our field experiment if these dynamics alter the exogenously imposed ethnic composition of teams.

During the year 104 students (19%) dropped out.[11] This reduced the average team size from approximately 12 at the start to about 10 at the end of the program. The design of our field experiment was not contaminated by dropouts. First, the ethnic composition of teams is largely unaffected. The correlation between teams' share of minorities at baseline and at the end of the program is 0.86. Second, dropout rates do not vary across teams in relation to their ethnic composition. Regression coefficients of the share of minorities at baseline (and its square) when explaining dropout decisions are insignificant.

Companies appoint a management team twice, for the first and second half of the program. Tests indicate that the ethnic diversity of the entire team - on which the treatment is based - is a realistic reflection of the management team (possibly the more influential part of the team). Regressing the share of minorities in the management team on the share of minorities in the entire team returns a coefficient of 0.95 for the first half of the

[11] Dropout rates for first-year students in Dutch higher vocational schools are about 30% on average, including students that switch study and/or school (ref. HBO-raad, 2010). Lower dropout rates than the national average at the department of international business studies of the Amsterdam College of Applied Sciences may be explained by the fact that international programs generally attract students that are more motivated.

program and 0.97 for the second half.[12] Moreover, students of non-Dutch ethnicity are not significantly more or less likely to be part of the management team than students of Dutch ethnicity in each of the semesters.

In sum, we are confident that the composition dynamics that take place after the initial assignment of students to teams did not compromise the design of our field experiment.

Incentives

The entrepreneurship program provides various (team and individual) incentives to align students' interests with the business performance of their company. At the indidual level, incentives are generated by the threat of dismissal in case of underperformance. This implies exclusion from the program, a loss of credit points and thus a much lower chance of obtaining an undergraduate degree (that requires a minimum number of credit points in the first year). Dismissal requires two-third of the team members' votes together with the consent of their professor. It is a credible threat. Half of the teams experiences at least one dismissal and the average number is 0.73 per team.[13]

Students' grades for the program (20% of GPA) are determined by both individual and team performance and their weight in the total program grade is about 50/50. An indicator of the considerable weight of individual performance is that the average difference between the highest and lowest grade within a team is approximately 1.3 (on a scale from 1 to 10). The relevance of team performance for students' grades is indicated by the positive correlations between the average grade in the team and business performance in terms of, for example, sales (0.34) or positive profits (0.18).

Incentives are further provided by a formal business competition. At the end of the program, six selected teams present their results in a 'business pitch' to a jury of entrepreneurs who select a winner based on business outcomes and presentations. The winning team obtains a cup, often gets some (local) press attention and represents the college in the national competition. In addition, virtually all students own shares of their company. Other shareholders are usually family members, friends or acquaintances.

Reported effort levels - collected through questionnaires - in terms of hours may be

[12] These coefficients are similar for median regressions that minimize the effect of possible outliers. F-tests further indicate that none of these coefficients are significantly different from 1.

[13] The incidence and number of dismissals are unrelated to both the business performance and the ethnic composition of teams.

considered a quantitative reflection of the effectiveness of these incentives. On average, students spend about 8.1 hours per week (s.d. 3.8) on the program, which covers 20% of their curriculum. This is substantial relative to the 32 hours per week students in Dutch higher vocational schools on average spend on their education (Allen et al., 2009). The incentives discussed above make it likely that the efforts of students are directed towards the business outcomes we measure.

3 Data

Data about teams and individuals was collected through administrative data, teams' annual reports and three extensive surveys. Students filled out a survey at the first day of the academic year (pretreatment, in September 2008), halfway (in January 2009) and at the end of the entrepreneurship program (posttreatment, in May 2009). Response rates are respectively 88%, 86% and 78%. We use the information from the questionnaires for various purposes. Based on this, we check the validity of the name-based assignment of students to ethnicities and the random assignment of students to teams given their ethnic background. Moreover, the questionnaires enable us to relate our findings to and control for individual and team characteristics and processes regarding complementarities, (mutual) learning, communication and coordination.[14]

Table 3 reports descriptive statistics of individual and team characteristics. The pretreatment survey administers background characteristics such as age and gender. In addition, we measure scholastic achievements of students just before entering the college (indicated by 'grade point average'). All three surveys also include self-assessments of the knowledge that students have in seven areas relevant for their studies. From these, we select the three most relevant knowledge areas for successful entrepreneurship and include them in our analyses of complementarities and learning (see Karlan and Valdivia, 2011; Minniti and Bygrave, 2001).[15] We use the individual development of these knowledge areas

[14] In Hoogendoorn et al. (2013) other processes were analyzed too, for example, those related to monitoring and decision making. In this paper, nonformal theories provide more guidance as to which processes would matter, enabling us to consider a more limited set.

[15] The knowledge areas that we include are related to business, entrepreneurship and leadership (thereby excluding administration, strategy, organization and management). Besides, the questionnaires administer self-assessments of entrepreneurial skills such as creativity, market awareness and networking (see Hoogendoorn et al., 2013; Oosterbeek et al., 2010; Parker, 2009). We left them out from further analyses. The entrepreneurial skills turned out not to be developed significantly during the entrepreneurship program

Table 3. Descriptive statistics of individual and team characteristics

	Scale	Mean	SD	Min	Max
Individual level					
Age	years	19.37	1.99	15.98	30.92
Gender (dummy = 1 if female)	0/1	0.44	0.50	0.00	1.00
Grade point average	1-10	6.46	0.24	6.05	7.23
Business knowledge	1-5	2.66	0.88	1.00	5.00
Entrepreneurship knowledge	1-5	2.71	0.98	1.00	5.00
Leadership knowledge	1-5	3.14	0.98	1.00	5.00
Team level					
Size (at baseline)	persons	12.22	2.09	8.00	16.00
Conflicts	1-5	2.23	0.59	1.00	3.67
Atmosphere	1-5	3.53	0.55	2.33	4.83

Note: Through standard batteries of questions we also obtain (non-tabulated) validated measures of 'softer' individual characteristics that are associated with entrepreneurship such as the 'big five' factor model of personality structure (see Goldberg, 1990; Zhao and Seibert, 2006). These are left out from the table for the purpose of presentation and not used in any of the analyses; there are no pretreatment differences.

during the program as a proxy for learning. The levels reported in Table 3 are knowledge levels at baseline on a scale from 1 to 5. These initial levels also form the basis for our constructed measure of complementarities. As we will discuss more thoroughly in Section 4, self-assessments of team members about the team's atmosphere and the prevalence of conflicts are proxies for communication and coordination in teams.

Business performance metrics are gathered or calculated from the companies' annual reports that we obtained from 43 out of 45 teams. We measure sales, profits and profits per share in euros. We also add a binary indicator of positive profits because students tend to view as the bottom line result whether they are able to satisfy their shareholders. Column (1) of Table 4 shows that average sales for all teams amount to 838 euros with a standard deviation of 707 euros. Profits are on average negative at -69 euros varying from a loss of 1016 euros to a profit of 477 euros. 22 teams make positive profits, while 21 teams run a loss. Profits per share vary between -15 and +15 euros.[16]

Columns (2) through (7) of Table 4 present descriptive statistics of business outcomes for different degrees of ethnic diversity. We tabulate two pairs of cutoff levels around the average share of minorities in the sample of 0.55. Columns (2) through (4) with

and we observed no pretreatment differences forcing us to use them as controls.

[16]Shares have a nominal value of 20 euros. The mean number of shares issued is 52 (s.d. 21.5), while the minimum and maximum numbers of shares sold are respectively 15 and 100. Roughly half of the shares are owned by team members themselves (approximately 50 euros per student on average); the remaining shareholders are usually family members, friends or acquaintances. The number of shares and, hence, funding of companies is unrelated to the ethnic diversity of teams.

Table 4. Descriptive statistics of business outcomes

			Ethnic diversity (0.45 and 0.65)			Ethnic diversity (0.40 and 0.60)		
		All	Low share<0.45	Moderate 0.45≥share≤0.65	High share>0.65	Low share<0.40	Moderate 0.40≥share≤0.60	High share>0.60
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sales (euros)	Mean	838	859	881	745	1183	826	735
	SD	707	634	891	349	622	895	468
	Min	0	130	0	265	593	130	0
	Max	4209	2226	4209	1267	2226	4209	1953
Profits (euros)	Mean	-69	-39	-146	41	-97	-78	-51
	SD	318	375	346	164	468	294	305
	Min	-1016	-1011	-1016	-247	-1011	-848	-1016
	Max	477	294	477	294	294	477	294
Positive profits (0/1)	Mean	0.51	0.70	0.29	0.75	0.67	0.37	0.61
	SD	0.51	0.48	0.46	0.45	0.52	0.50	0.50
	Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Max	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Profits per share (euros)	Mean	-0.51	0.42	-2.07	1.46	-1.84	-0.58	0.01
	SD	6.42	7.75	6.33	5.07	7.05	6.64	6.29
	Min	-15.48	-15.48	-12.87	-8.04	-15.48	-11.78	-12.87
	Max	15.64	15.64	11.36	12.79	3.67	15.64	12.79
N		43	10	21	12	6	19	18

cutoffs at 45% and 65% of minorities indicate that teams of high ethnic diversity tend to perform better than teams of moderate ethnic diversity in terms of profits, the probability of profits being positive and profits per share. Performance differences are less pronounced in a comparison between teams of low and high ethnic diversity, although the descriptive statistics suggest that on average business outcomes are slightly higher for teams of high ethnic diversity. Columns (5) through (7) show a similar pattern for more symmetric cutoff levels at a share of minorities of 0.40 and 0.60. However, we lack support among teams of low ethnic diversity due to the limited number of observations in the range below 40% of minorities (only 6 teams). In what follows, our main focus is therefore on teams with a moderate or high share of minorities (i.e., teams of moderate or high ethnic diversity).

Table 5. Randomization checks

	Share of minorities	
Personal characteristics		
Age	-0.093	(0.473)
Gender	-0.193	(0.166)
Grade point average	-0.052	(0.058)
Knowledge of		
Business	0.380	(0.283)
Entrepreneurship	-0.039	(0.276)
Leadership	-0.308	(0.282)
Field of study		
Business management	-0.562	(0.432)
Management	-0.075	(0.272)
Trade management Asia	0.815**	(0.354)
Business languages	-0.328	(0.408)
Financial management	0.150	(0.148)
Team size	1.579	(1.820)

Note: Based on information from 43 teams. Each coefficient comes from a regression at the team level of the row variable on the share of minorities (bootstrapped standard errors in parentheses; 1000 replications). ***/**/* denotes significance at the 1%/5%/10%-level.

Randomization

We examine at the team level whether (average) characteristics of students correlate with the ethnic composition of teams. Table 5 shows that ethnic diversity is not systematically related to any of the (average) team characteristics except for the likelihood of studying 'trade management Asia'. Teams with higher shares of minorities are no different from teams with lower shares of minorities with respect to age, gender, GPA or initial levels

of entrepreneurship related knowledge. The 'omnibus' p-value of the Chi squared test of the joint significance of all these relevant predetermined characteristics in explaining the share of ethnic minority students in teams is 0.62.

To further examine whether students are randomly assigned to teams of different ethnic composition, we have also regressed individual students' characteristics on the share of minorities in their team, both jointly and separately for students of Dutch and non-Dutch ethnicity. For these regressions at the individual level, the 'omnibus' p-value of a Chi-squared test of the joint significance across all of the relevant predetermined student characteristics included in Table 5 are 0.25 for the total sample of students ($n = 434$, for which all regressor values are available), 0.27 for the subsample of Dutch students ($n = 182$) and 0.08 for the subsample of ethnic minority students ($n = 252$). In these joint regressions, the only coefficients that are significant belong to the dummy variable distinguishing students in the field of study 'trade management Asia'. Based on these analyses, all analyses in the next section include a dummy to control for the field of study 'trade management Asia'.

4 Results

4.1 Main findings

Table 6 shows the relationship between the share of minorities in a team and four measures of business performance: sales, profits, the probability of profits being positive and profits per share. Note that a larger share of minorities implies a more ethnically diverse team due to the limited presence of ethnic clusters within teams. In panel A the performance measures are regressed on the share of minorities in the team (using OLS, median and robust M-estimation regression). These specifications testing for a linear effect of the share of minorities on business performance turn out insignificant. We also test polynomial specifications in panel B and these turn out being (largely) insignificant too, although the point estimates consistently suggest a u-shaped relationship between the share of minorities and business performance with the minimum at a share of about 0.55.

Panels C1 through C3 of Table 6 measure the effect of ethnic diversity on business performance using more flexible spline functions. Using these, we further explore the

Table 6. Ethnic diversity and team performance

	Sales			Profits			Pos. profits	Profits per share		
	OLS	Median	Robust	OLS	Median	Robust	OLS	OLS	Median	Robust
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A: Linear										
% minorities	-597.8	-267.3	15.3	106.7	3.2	-71.4	0.153	3.779	-0.122	1.751
	(624.5)	(722.2)	(664.3)	(318.0)	(330.0)	(237.8)	(0.528)	(6.200)	(5.995)	(5.556)
R^2	*0.02*	*0.03*	*0.03*	*0.02*	*0.03*	*0.00*	*0.03*	*0.01*	*0.01*	*0.00*
B: Polynomial										
% minorities	-3798.5	-3780.9	-5009.1	-1741.8	-3018.7*	-2215.7	-4.622	-29.232	-40.341	-48.841
	(3968.5)	(4734.9)	(4322.8)	(2071.2)	(1621.2)	(1567.4)	(3.170)	(34.954)	(33.848)	(35.781)
% minorities^2	2942.8	3561.9	4306.0	1699.5	2664.7*	1942.6	4.391	30.350	36.524	45.266
	(3528.0)	(4040.7)	(3646.3)	(1671.1)	(1381.7)	(1316.9)	(2.693)	(28.902)	(29.662)	(29.096)
Minimum	*0.65*	*0.53*	*0.58*	*0.51*	*0.57*	*0.57*	*0.53*	*0.48*	*0.55*	*0.54*
R^2	*0.04*	*0.05*	*0.11*	*0.05*	*0.06*	*0.08*	*0.11*	*0.04*	*0.05*	*0.07*
C1: Spline (0.50)										
1st segment	-977.5	-903.9	-1709.2	-598.8	-955.1	-964.8	-1.816	-7.962	-18.541	-19.408
	(2308.9)	(2238.4)	(1938.0)	(1046.5)	(958.6)	(947.3)	(1.469)	(17.040)	(18.435)	(19.467)
2nd segment	-359.8	786.2	722.2	548.8	405.2	442.1	1.387*	11.137	11.402	13.080
	(1347.9)	(1072.7)	(834.8)	(398.8)	(445.5)	(401.3)	(0.811)	(8.285)	(10.001)	(8.892)
R^2	*0.02*	*0.05*	*0.08*	*0.05*	*0.05*	*0.08*	*0.11*	*0.03*	*0.05*	*0.07*
C2: Spline (0.55)										
1st segment	-1205.2	-903.9	-1102.3	-568.9	-955.1	-946.6*	-1.801*	-9.349	-17.288	-17.494
	(1404.8)	(1521.8)	(1451.2)	(766.7)	(647.4)	(559.9)	(1.088)	(13.563)	(10.851)	(12.553)
2nd segment	35.7	786.2	790.7	811.3*	1007.6**	757.9*	2.191**	17.471*	16.378*	19.601**
	(1199.3)	(1191.1)	(921.3)	(459.4)	(486.3)	(401.8)	(0.872)	(9.552)	(9.696)	(8.261)
R^2	*0.03*	*0.05*	*0.07*	*0.06*	*0.08*	*0.13*	*0.17*	*0.05*	*0.07*	*0.10*
C3: Spline (0.60)										
1st segment	-1200.1	-903.9	-814.2	-514.4	-718.5	-786.4*	-1.422*	-8.327	-14.429	-14.789
	(1012.2)	(1329.7)	(1191.7)	(630.3)	(497.0)	(424.9)	(0.854)	(10.805)	(9.575)	(10.222)
2nd segment	464.8	1733.7	1079.4	1202.3*	1257.0**	1042.3**	2.933**	25.136**	22.331*	26.773**
	(1236.0)	(1609.5)	(1155.7)	(632.2)	(607.1)	(517.3)	(1.143)	(11.410)	(12.322)	(10.950)
R^2	*0.03*	*0.05*	*0.06*	*0.08*	*0.08*	*0.14*	*0.18*	*0.07*	*0.08*	*0.12*

Note: Based on information from 43 teams. All specifications include a dummy for the field of study 'trade management Asia'. OLS, Median and Robust refer to the estimation method. Median and robust specifications for positive profits are excluded since this variable is dichotomous. Bootstrapped standard errors in parentheses (1000 replications). ***/**/* denotes significance at the 1%/5%/10%-level.

possibility described in Section 1 that the relationship between team performance and diversity is nonlinear. Spline functions allow distinct slopes for various parts of the distribution of ethnic diversity, unlike the linear specification in Panel A. Moreover, they do not impose equal curvatures of opposite signs below and above the fraction of ethnic minority members at which team performance is lowest, as is the case with a quadratic specification (see Panel B). In particular, using spline functions and focussing on the right handside of the distribution, we may find some indicative evidence of rising net benefits after a certain tipping point as was suggested by nonformal theories. We explore different cutoff levels around the sample average of 55% of minorities.

Panel C1 reports the slopes of the estimated linear relationship between ethnic diversity in the team and business performance below and above 50% of minorities in the first and second row, respectively. The coefficients are not significantly different from zero. Panel C2 shows the results for the cutoff at a share of minorities of 0.55. All point estimates for the share of minorities, given that this share is above 0.55, are positive (and except for sales) statistically significant. When the share of minorities is lower than or equal to 0.55, all coefficients are negative and in two cases significantly so. The point estimate in column (5) of panel C2 implies that profits increase by 100 euros (about one-third of a standard deviation) if the share of minorities is raised from 0.6 to 0.7. Panel C3 reveals a similar pattern for the relationship between business performance and ethnic diversity above and below 60% of minorities: profits, the probability of profits being positive and profits per share only increase with the share of minorities in the segment above 60% of minorities.[17]

Panels C1 through C3 of Table 6 show that these results are not driven by outliers; they are largely insensitive to using OLS, median or robust M-estimation regression. Moreover, (non-tabulated) results from estimating these spline functions with different cutoff levels such as at a share of minorities of 0.45 or 0.65 give similar results as the ones tabulated for cutoff levels at 50%, 55% or 60% of minorities. Table A1 in the appendix further indicates that the results also remain similar when estimating spline functions with three segments (i.e., with teams of low, moderate and high ethnic diversity). The business performance of teams in the segments of low and moderate ethnic diversity is on average less strongly

[17] F-tests acknowledge that the coefficients of the first and second segment in panels C2 and C3 are not identical for profits, the probability of profits being positive and profits per share (not tabulated).

affected by increasing the percentage of ethnic team members relative to the segment of high ethnic diversity. However, the (more limited) number of teams in each segment may slightly limit the precision of the estimates.

The results presented in this subsection suggest that the relationship between team performance and ethnic diversity is flat or tends to decline down to a certain threshold. However, the data indicate that there is a substantial and significantly positive marginal effect of ethnic diversity on business performance beyond this threshold. The threshold level is around a share of minorities of 0.55. Hence, it seems that only if ethnic diversity is sufficiently substantial the net effect of ethnic diversity on team performance is positive. This finding provides suggestive evidence consistent with the idea of a tipping point.

4.2 Costs and benefits of ethnic diversity

In this subsection we explore whether our data, collected through the questionnaires, indeed suggest mechanisms that possibly drive the effect of ethnic diversity on team performance. If the variable that we employ as an indicator of a mechanism is unrelated to the ethnic diversity of teams then we can conclude that this mechanism will not explain our findings. On the other hand, if we find a relationship between a certain mechanism and ethnic diversity then this mechanism possibly contributes to the explanation of our results. However, for the mechanism to actually explain our findings, it also needs to have an impact on team performance.

Unfortunately, we cannot conceive of a research design (including ours) that allows testing this. For example, on the one hand, a positive relationship between learning and team performance may indicate that learning by the team improves performance. On the other hand, team performance may influence team members' individual assessment of how much learning took place. For this reason, the estimated relationship between learning measures and ethnic diversity is open to multiple interpretations and certainly not indicative of a causal effect of team composition on learning. Nevertheless, we think it is useful to explore the occurence of this kind of relationships that may possibly explain our findings. In what follows, we first consider the mechanisms that are associated with the costs of ethnic diversity and subsequently the mechanisms that are related to its benefits.

For communication and coordination, we expect that moderately heterogeneous teams

incur higher costs of communication and coordination than teams that are homogeneous or heterogeneous in terms of ethnicity. We measure coordination and communication costs in terms of a team's atmosphere and personal conflicts (see Earley and Mosakowski, 2000; Richard et al., 2004). Teams' atmosphere is administered by asking students to rate the atmosphere within their team on a 5-points scale in the posttreatment survey. Likewise, conflicts in the team are surveyed by asking students to what extent there was conflict or disagreement between team members about personal matters (that are not task-related). More personal conflicts and a worse team atmosphere are expected to coincide with worse communication and coordination due to, for example, subgrouping along ethnic lines, distrust or stereotyping. In line with Alesina and La Ferrara (2005), we find that homogeneous and moderately heterogeneous teams tend to experience less conflicts than heterogeneous teams (not tabulated). However, the data also indicate that teams' atmosphere and ethnic diversity are not significantly related. In sum, these results do not consistently suggest that the costs of communication and coordination might drive our main findings.

For the benefits, we expect a positive relationship between ethnic diversity and business performance due to more complementarities and (mutual) learning in ethnically diverse teams. We measure learning in terms of the development in three knowledge areas most relevant for successful entrepreneurship: business, entrepreneurship and leadership (see Karlan and Valdivia, 2011; Minniti and Bygrave, 2001). For each of these knowledge areas, the indicator of individual learning is the difference between the self-assessed level in the posttreatment and pretreatment questionnaire. Table 7 reports results from least squares regressions (panels A and B) and spline functions (panels C1 through C3) of team-average learning in business, entrepreneurship and leadership knowledge on ethnic diversity. Again, we present results from using OLS, median and robust M-estimation regression. Panel A shows no significant linear effect of the share of minorities on learning, whereas panel B suggests a u-shaped relationship with the minimum at a share of approximately 0.55.

Spline functions in panels C1 through C3 of Table 7 with a cutoff at respectively 50%, 55% or 60% of minorities indicate that the relationship between learning and share of minorities is flat or declines down to a threshold level of about 0.55 and starts increasing beyond this threshold level. Hence, on average, members of ethnic heterogeneous teams

Table 7. Learning and ethnic diversity

	Development in knowledge of								
	Business			Entrepreneurship			Leadership		
	OLS	Median	Robust	OLS	Median	Robust	OLS	Median	Robust
	(1)	(2)	(3)	(4)	(5)	(6)	(8)	(9)	(10)
A: Linear									
% minorities	0.275	0.054	0.241	-0.090	0.061	-0.138	0.237	0.032	0.232
	(0.436)	(0.485)	(0.471)	(0.351)	(0.590)	(0.389)	(0.393)	(0.660)	(0.465)
R^2	*0.34*	*0.24*	*0.42*	*0.34*	*0.18*	*0.32*	*0.30*	*0.16*	*0.27*
B: Polynomial									
% minorities	-2.670	-1.874	-2.659	-3.455**	-3.835	-3.669	-3.789**	-3.825	-3.999**
	(1.970)	(2.385)	(2.476)	(1.727)	(2.889)	(2.540)	(1.799)	(2.617)	(1.903)
% minorities^2	2.690	1.891	2.514	3.088**	3.228	3.192	3.691**	3.468	3.891**
	(1.656)	(2.035)	(2.157)	(1.557)	(2.568)	(2.344)	(1.650)	(2.494)	(1.810)
Minimum	*0.50*	*0.50*	*0.53*	*0.56*	*0.59*	*0.57*	*0.51*	*0.55*	*0.51*
R^2	*0.38*	*0.27*	*0.47*	*0.39*	*0.25*	*0.37*	*0.38*	*0.24*	*0.33*
C1: Spline (0.50)									
1st segment	-1.067	-1.331	-0.897	-1.471	-2.057*	-1.741	-1.324*	-1.705	-1.607
	(0.919)	(1.182)	(1.244)	(0.913)	(1.088)	(1.138)	(0.760)	(1.029)	(1.090)
2nd segment	1.049*	0.867	0.779	0.753	0.858	0.752	1.191**	1.131	1.374**
	(0.623)	(0.656)	(0.622)	(0.530)	(0.745)	(0.624)	(0.549)	(0.852)	(0.686)
R^2	*0.38*	*0.26*	*0.46*	*0.39*	*0.26*	*0.37*	*0.37*	*0.26*	*0.36*
C2: Spline (0.55)									
1st segment	-0.786	-0.731	-0.881	-1.270**	-1.833**	-1.476**	-1.142*	-1.247	-1.287*
	(0.649)	(0.811)	(0.798)	(0.646)	(0.846)	(0.693)	(0.635)	(0.749)	(0.712)
2nd segment	1.321**	0.908	1.091	1.130*	1.219	1.114	1.662***	1.243	1.729**
	(0.656)	(0.757)	(0.685)	(0.599)	(0.876)	(0.711)	(0.626)	(0.869)	(0.729)
R^2	*0.38*	*0.28*	*0.49*	*0.41*	*0.27*	*0.41*	*0.41*	*0.28*	*0.37*
C3: Spline (0.60)									
1st segment	-0.493	-0.638	-0.731	-0.971*	-1.568**	-1.179**	-0.831	-1.175	-0.896
	(0.638)	(0.686)	(0.625)	(0.553)	(0.764)	(0.569)	(0.525)	(0.756)	(0.655)
2nd segment	1.585*	1.304	1.459	1.480*	1.540	1.499	2.133**	2.502*	2.129*
	(0.873)	(1.144)	(1.100)	(0.793)	(1.209)	(1.046)	(0.883)	(1.345)	(1.228)
R^2	*0.38*	*0.28*	*0.51*	*0.40*	*0.25*	*0.40*	*0.41*	*0.25*	*0.36*

Note: Based on information from 43 teams. All specifications include controls for team size, field of study 'trade management Asia' and team-average knowledge levels at baseline. OLS, Median and Robust refer to the estimation method. Bootstrapped standard errors in parentheses (1000 replications). ***/**/* denotes significance at the 1%/5%/10%-level.

Table 8. Complementarities and diversity in relevant knowledge

	Complementarities			Diversity in knowledge of								
	Business/E'ship/Leadership			Business			Entrepreneurship			Leadership		
	OLS	Median	Robust	OLS	Median	Robust	OLS	Median	Robust	OLS	Median	Robust
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
A: Linear												
% minorities	0.690	1.397	1.181	0.129*	0.186	0.126	0.105	0.079	0.096	-0.059	-0.047	-0.049
	(0.533)	(0.872)	(0.920)	(0.076)	(0.127)	(0.094)	(0.109)	(0.160)	(0.132)	(0.071)	(0.105)	(0.084)
R^2	*0.28*	*0.22*	*0.41*	*0.54*	*0.32*	*0.46*	*0.17*	*0.03*	*0.14*	*0.23*	*0.13*	*0.19*
B: Polynomial												
% minorities	-3.776	-4.352	-2.763	-0.371	-0.639	-0.402	-0.766	-1.038	-0.786	-0.597	-0.272	-0.599
	(3.132)	(4.273)	(4.155)	(0.418)	(0.662)	(0.502)	(0.520)	(0.809)	(0.657)	(0.364)	(0.580)	(0.446)
% minorities^2	4.065	4.517	3.828	0.457	0.670	0.483	0.800*	0.978	0.811	0.493	0.211	0.503
	(2.697)	(3.784)	(3.742)	(0.371)	(0.574)	(0.433)	(0.475)	(0.733)	(0.605)	(0.323)	(0.518)	(0.402)
Minimum	*0.46*	*0.48*	*0.36*	*0.41*	*0.48*	*0.42*	*0.48*	*0.53*	*0.48*	*0.61*	*0.64*	*0.60*
R^2	*0.35*	*0.24*	*0.58*	*0.56*	*0.34*	*0.51*	*0.23*	*0.10*	*0.20*	*0.28*	*0.15*	*0.24*
C1: Spline (0.50)												
1st segment	-1.376	-1.680	-1.321	-0.025	0.040	-0.041	-0.239	-0.356	-0.246	-0.245	-0.156	-0.229
	(1.318)	(1.862)	(1.754)	(0.179)	(0.292)	(0.216)	(0.208)	(0.315)	(0.247)	(0.164)	(0.259)	(0.185)
2nd segment	1.878**	2.126*	2.144*	0.218*	0.234	0.224	0.315*	0.309	0.311	0.054	0.027	0.061
	(0.812)	(1.243)	(1.253)	(0.124)	(0.174)	(0.143)	(0.170)	(0.260)	(0.213)	(0.104)	(0.183)	(0.126)
R^2	*0.37*	*0.26*	*0.40*	*0.55*	*0.33*	*0.50*	*0.23*	*0.09*	*0.19*	*0.27*	*0.14*	*0.22*
C2: Spline (0.55)												
1st segment	-0.526	-0.054	-0.392	-0.016	-0.159	-0.033	-0.177	-0.272	-0.183	-0.201	-0.150	-0.189
	(1.053)	(1.437)	(1.325)	(0.148)	(0.232)	(0.182)	(0.162)	(0.244)	(0.191)	(0.135)	(0.185)	(0.144)
2nd segment	1.889*	1.960	2.167	0.273*	0.330	0.286	0.397**	0.464	0.391	0.086	0.031	0.099
	(1.000)	(1.649)	(1.451)	(0.150)	(0.217)	(0.188)	(0.196)	(0.319)	(0.258)	(0.122)	(0.218)	(0.159)
R^2	*0.34*	*0.24*	*0.37*	*0.56*	*0.34*	*0.51*	*0.24*	*0.11*	*0.19*	*0.27*	*0.14*	*0.22*
C3: Spline (0.60)												
1st segment	0.022	0.783	0.790	-0.012	-0.068	-0.032	-0.134	-0.167	-0.147	-0.172	-0.143	-0.167
	(0.929)	(1.312)	(1.246)	(0.119)	(0.190)	(0.158)	(0.139)	(0.216)	(0.173)	(0.111)	(0.167)	(0.124)
2nd segment	1.831	1.933	2.830	0.370*	0.401	0.397*	0.532**	0.507	0.534	0.141	0.054	0.157
	(1.335)	(1.932)	(1.843)	(0.190)	(0.279)	(0.229)	(0.254)	(0.395)	(0.329)	(0.165)	(0.271)	(0.197)
R^2	*0.31*	*0.22*	*0.57*	*0.56*	*0.35*	*0.52*	*0.26*	*0.11*	*0.21*	*0.27*	*0.14*	*0.23*

Note: Based on information from 43 teams. All specifications include controls for team size, field of study 'trade management Asia' and team-average knowledge levels at baseline. OLS, Median and Robust refer to the estimation method. Bootstrapped standard errors in parentheses (1000 replications). ***/**/* denotes significance at the 1%/5%/10%-level.

learn more than members of homogeneous and moderately heterogeneous teams. Additional regressions at the individual level, that we run separately for students of Dutch and non-Dutch ethnicity, show that the learning benefits of more ethnic diversity accrue to similar extents to both groups (not tabulated). Moreover, and probably as an explanatory factor of the higher learning levels in more diverse teams, the data show some evidence that ethnically diverse teams enter the entrepreneurship program at the start with a more diverse pool of relevant knowledge than less heterogeneous teams (see Lazear, 1999). Table 8 indicates that complementarities between team members and the coefficients of variation of business, entrepreneurship and leadership knowledge at baseline tend to be larger in ethnically diverse teams.[18]

All in all, based on these results we cannot reject the idea that ethnic diversity benefits (mutual) learning and heterogeneous knowledge, possibly leading to better team performance. This finding is partly consistent with the theoretical ideas formulated in Section 1. Ethnically diverse teams tend to have a more diverse pool of relevant knowledge and (possibly based on this) experience more learning and achieve better results. However, we do not find support for the idea that moderately heterogeneous teams incur higher costs of coordination and communication.

5 Discussion and conclusion

This paper shows that the causal impact of ethnic diversity in teams on their business performance is insignificant for a large part of the distribution. The relationship between team performance and ethnic diversity in our field experiment turned out to be flat or slightly declining for the subsample of teams where the majority of team members is from the same (Dutch) ethnic origin. Currently, this is the team composition of most teams in (business) practice. Indeed, this part of our result is in line with earlier results from analyzing real-world teams. However, we found a somewhat different result for teams in

[18] In Table 8 a diverse pool of relevant knowledge at the start of the program is operationalized by: (i) complementarities between the self-assessed knowledge that team members have in business, entrepreneurship and leadership, and (ii) the coefficients of variation of business, entrepreneurship and leadership knowledge in teams at baseline. Complementarities are constructed by first standardizing all three knowledge dimensions, subsequently computing the teams' maximum for each knowledge dimension, and then determining the teams' minimum of the maximums of all three knowledge dimensions. Supposedly, if students of different ethnicity complement each others knowledge, these minimums are higher in ethnically diverse teams.

which the majority of their members have different ethnic origins. In case of an ethnically diverse team, more ethnic diversity in the team turns out to have a significantly positive marginal effect on business performance. Hence, it seems that only if ethnic diversity is sufficiently substantial the net effect of ethnic diversity on team performance is positive.

The case of truly ethnically diverse teams has not been studied before, but will probably become very realistic in the near future. Our findings provide suggestive evidence consistent with a threshold or tipping point. Malcolm Gladwell (2000, p.29): "The Tipping Point is that magic moment when an idea, trend or social behavior crosses a threshold, tips, and spreads like wildfire. At what point does it become obvious that something has reached a boiling point and is about to tip?" Within truly heterogeneous teams, something starts spreading like wildfire. In line with theoretical predictions (Lazear, 1999), our data suggest that 'this something' that truly ethnically diverse teams benefit from is a more diverse pool of relevant knowledge facilitating (mutual) learning.

Our study is motivated by the fact that many decisions in organizations are nowadays assigned to teams (Hamilton et al., 2003) that become increasingly diverse due to the changing composition of Western populations (e.g., Ozgen et al., 2011b). One of the most salient and relevant dimensions of team heterogeneity is ethnicity (Alesina and La Ferrara, 2005). Until today, however, studies analyzing the causal effect of ethnic diversity on team performance in the longer run have been scarce.

We have tried to fill this gap in the empirical literature by conducting a field experiment. The field experiment was conducted in the context of a worldwide leading entrepreneurship education program in one of the largest colleges in Amsterdam. The program is executed as a part of the curriculum of their international business program. Real companies are founded in identical circumstances by 45 teams of approximately 12 students. The student population consists of 55% students with a non-Dutch ethnicity from 53 different countries of origin. As outside researchers, we were allowed to exogenously vary the ethnic composition of otherwise randomly composed teams. Since the program requires students to deliver annual reports, we could measure their performance in terms of sales, profits and profits per share. All in all, this is a genuinely interesting opportunity to measure the longer term effect of ethnic diversity on team performance in realistic though controlled circumstances.

Several limitations pertain to this study. There are discrepancies between the business teams in our study and teams in business practice. Individuals in our teams are relatively young, lack serious labor market experience and some of the teams have unprecedented high degrees of ethnic diversity. These characteristics might, to some extent, limit the external validity of our study. Moreover, although advantageous for the internal validity of our study, the random composition of teams is probably not representative of common practice in business. Finally, our experimental design does not allow for a causal interpretation of mechanisms such as (mutual) learning that lead to higher performance of ethnic heterogeneous teams.

Nevertheless, teams' substantial and genuinely joint task with strong incentives to maximize performance of a real company in which team members have time to establish roles and observations of other members closely resembles the functioning of teams in business practice. Given the upcoming increase of the share of minorities in the labor force it is likely that any team will become more and more diverse in terms of ethnicity. Our study might provide a realistic preview of the impact that a high degree of ethnic diversity may have on the performance of teams.

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Appendix Table A1. Ethnic diversity and team performance (spline functions with three segments)

	Sales			Profits			Pos. profits	Profits per share		
	OLS	Median	Robust	OLS	Median	Robust	OLS	OLS	Median	Robust
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
C1: Spline (0.50 and 0.60)										
1st segment	-72.3	-903.9	-1475.2	-25.5	19.5	-298.3	-0.566	5.519	-1.568	-1.451
(N=13)	(3383.4)	(2832.8)	(2542.9)	(1305.0)	(1091.9)	(1186.7)	(1.553)	(20.586)	(21.003)	(21.464)
2nd segment	-3855.7	-1702.8	379.6	-1665.6	-2380.6	-1827.1	-3.438	-40.931	-44.992	-45.332
(N=12)	(5694.8)	(4160.3)	(3194.1)	(1924.9)	(1993.9)	(1789.0)	(2.537)	(34.724)	(41.217)	(38.860)
3rd segment	1121.1	1863.9	832.5	1486.8**	1533.8*	1272.7*	3.431***	33.194**	30.027*	33.510**
(N=18)	(1511.8)	(1730.1)	(1324.0)	(750.4)	(836.2)	(743.1)	(1.329)	(13.609)	(17.104)	(15.465)
R^2	*0.05*	*0.05*	*0.07*	*0.09*	*0.09*	*0.16*	*0.20*	*0.09*	*0.09*	*0.14*
C2: Spline (0.45 and 0.65)										
1st segment	-1982.7	-4112.3	-3445.7	-70.7	-729.5	-546.6	-0.833	9.147	-14.834	-3.369
(N=10)	(3386.2)	(3331.4)	(3215.0)	(1601.9)	(1746.8)	(1919.0)	(2.146)	(28.721)	(31.870)	(37.745)
2nd segment	-441.6	-52.1	660.5	-362.8	-376.4	-463.8	-0.804	-13.556	-6.730	-14.604
(N=21)	(2170.7)	(1717.5)	(1429.9)	(782.4)	(971.8)	(727.6)	(1.413)	(17.582)	(22.359)	(18.522)
3rd segment	593.0	1953.7	869.7	1233.6	1519.5	1091.6	3.130*	32.469*	25.126	32.904
(N=12)	(1832.0)	(1960.7)	(1948.5)	(816.3)	(1036.6)	(952.3)	(1.753)	(16.937)	(24.939)	(21.982)
R^2	*0.04*	*0.06*	*0.14*	*0.05*	*0.06*	*0.08*	*0.13*	*0.06*	*0.05*	*0.08*
C3: Spline (0.40 and 0.60)										
1st segment	-3825.4	-8217.8	-5895.6	542.9	1449.7	-107.4	1.138	26.214	34.250	9.394
(N=6)	(4174.3)	(4985.2)	(5886.8)	(2788.9)	(3150.5)	(4286.7)	(3.301)	(48.628)	(53.268)	(77.093)
2nd segment	179.6	749.1	662.8	-1070.0	-1424.8*	-1119.5	-2.768**	-26.479	-32.143*	-28.274
(N=19)	(1455.4)	(1535.9)	(1291.8)	(828.7)	(807.7)	(680.6)	(1.213)	(17.121)	(16.135)	(18.670)
3rd segment	-91.0	786.2	487.1	1426.1**	1340.6*	1187.0**	3.475***	32.448***	27.426**	31.785**
(N=18)	(1172.0)	(1482.4)	(1219.8)	(685.2)	(693.3)	(584.7)	(1.169)	(12.559)	(13.511)	(13.311)
R^2	*0.05*	*0.08*	*0.22*	*0.10*	*0.10*	*0.15*	*0.22*	*0.11*	*0.10*	*0.14*

Note: Based on information from 43 teams. All specifications include a dummy for the field of study 'trade management Asia'. OLS, Median and Robust refer to the estimation method. Median and robust specifications for positive profits are excluded since this variable is dichotomous. Bootstrapped standard errors in parentheses (1000 replications). ***/**/* denotes significance at the 1%/5%/10%-level.