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Arthur E. Attema, PhD
Matteo M. Galizzi, PhD
Mona Groß, MSc
Heike Hennig-Schmidt, PhD
Yassin Karay, PhD
Olivier L'Haridon, PhD
Daniel Wiesen, PhD

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Authors
Arthur E. Attema, PhD, Erasmus School of Health Policy & Management
Matteo M. Galizzi, PhD, London School of Economics
Mona Groß, MSc, University of Cologne
Heike Hennig-Schmidt, PhD, University of Bonn
Yassin Karay, PhD, University of Cologne
Olivier L'Haridon, PhD, University of Rennes I
Daniel Wiesen, PhD, University of Cologne

Corresponding author: Daniel Wiesen, Department of Business Administration and Healthcare Management, University of Cologne, Germany; e-mail: wiesen@wiso.uni-koeln.de

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The formation of physician altruism*

Arthur E. Attema, Matteo M. Galizzi, Mona Groß, Heike Hennig-Schmidt,
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Abstract

We study how patient-regarding altruism is formed by medical education. We structurally estimate altruistic preferences using experimental data from a large sample of medical students (N=733) in Germany at different stages in their studies. The estimates reveal substantial heterogeneity in altruistic preferences of medical students. Patient-regarding altruism is highest for freshmen, significantly declines for students in the course of medical studies, and tends to increase again for last year students, who assist in clinical practice. Also, patient-regarding altruism is higher for females and positively associated to general altruism. Altruistic medical students have lower income expectations and are more likely to choose surgery and pediatrics as their preferred specialty.

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1 Introduction

Altruism is a key characteristic of physicians' behavior, and the notion of a benevolent physician is deeply rooted in the medical practice and ethics dating back to the Hippocratic Oath (e.g., Pellegrino, 1987; Beauchamp and Childress, 2001). The notion of physician altruism in economics was coined by

*Attema: Erasmus School of Health Policy & Management, Erasmus University Rotterdam, The Netherlands; e-mail: attema@eshpm.eur.nl, Galizzi: Department of Psychological and Behavioural Science, London School of Economics and Political Science, UK; e-mail: m.m.galizzi@lse.ac.uk, Groß: Department of Business Administration and Healthcare Management, University of Cologne, Germany; e-mail: mona.gross@wiso.uni-koeln.de, Hennig-Schmidt: Laboratory for Experimental Economics, Department of Economics, University of Bonn, Germany; e-mail: hschmidt@uni-bonn.de, Karay: University Hospital Cologne, e-amil: yassin.karay@uk-koeln.de, L'Haridon: Department of Economics, University of Rennes, and Paris School of Economics, France; e-mail: olivier.lharidon@univ-rennes1.fr, Wiesen: Department of Business Administration and Healthcare Management, University of Cologne, Germany; e-mail: wiesen@wiso.uni-koeln.de (corresponding author). We are grateful for valuable comments and suggestions from Francesca Barigozzi, Ben Greiner, Glenn Harrison, Rudolf Kerschbamer, Iris Kesternich, Mathias Kifmann, Albert Ma, Jing Li, Melanie Lührmann, Joachim Winter, and participants of conferences and seminars at the BEH Workshop Oslo, dggö Augsburg, dggö International Health Economics Workshop Mainz, EuHEA Seminar Series, Higher School of Economics, Innsbruck Winter School on Credence Goods, LMU Munich, NIPE University of Minho, NOeG Innsbruck, University of Hamburg, *VfS Gesundheitsökonomischer Ausschuss*, Webinar Series on Credence Goods and Expert Markets, and WU Vienna. We are highly indebted to the support of Prof. Markus Rothschild, Dr. Christoph Stosch, and Birger Reiss from the Medical Faculty of the University of Cologne. We thank Anne Classen, Kerstin Eilermann, Lotta Hinzpeter, and Ronald Schwarz for helping to conduct the experiments and Adriana Britz, Julie Damm, Kerstin Dannenberg, Anna Hanel, Helena Müller and Pauline Klassen for their excellent research assistance. Ethics approval was granted by the Ethics Board of the Medical School Cologne (EK 17-105).

Arrow (1963), who emphasized that a physician's behavior is "supposed to be governed by a concern for the customer's welfare which would not be expected of a salesman" (Arrow, 1963, p. 949). Following Arrow, a large economics literature showed that physician altruism has important implications, for example, on physicians' responses to incentives (e.g., Ellis and McGuire, 1986; Alexander, 2020), concerns for transparency (e.g., Kolstad, 2013), referrals (e.g., Allard et al., 2011; Liu and Ma, 2013), prescription patterns (e.g., Hellerstein, 1998; Crea et al., 2019), and occupational choices (e.g., Li, 2018). Also, the COVID-19 pandemic has indicated the relevance of physician altruism and has dramatically reignited the interest in the understanding of physician altruism.

While altruism plays a key role in physicians' behavior, there is, surprisingly, little direct evidence about the altruistic preferences of physicians, their distribution, and their formation over time. Although medical education and training plays a major role in forming professional values and altruistic concerns for the patient (e.g., Chandra et al., 2011), it is unknown whether and how medical education forms patient-regarding altruistic preferences of future physicians; for an early discussion of this question, see Hennig-Schmidt and Wiesen (2014).

This study contributes to filling the gap in the evidence on the link between altruism and medical education. First, we introduce a new measure of patient-regarding altruism in a medically framed economic experiment. Second, we structurally estimate altruism of medical students at different stages of their medical education. Finally, we link patient-regarding altruism of medical students to their individual characteristics and economic preferences, to their income expectations as well as to their stated occupational choices like preferred specialty. These contributions are based on the following research questions: How altruistic are medical students? How does patient-regarding altruism develop during medical education? How does patient-regarding altruism of medical students relate to their individual characteristics, income expectations and intended specialty choice?

To address these research questions, we conduct an incentivized behavioral experiment designed to directly measure and structurally estimate the patient-regarding altruistic preferences of a large, representative sample of 733 medical students from the University of Cologne, a major university and medical school in Germany. Our experimental design involves a series of medically framed stylized decisions, in which medical students are confronted with two treatment options involving trade-offs between profits for themselves and a health benefits for a patient. The patient health benefit is measured in monetary terms, and real-world patients outside the experiment benefit from the medical students' decisions as the experimental money is earmarked for cataract surgeries for real patients. Our sample of medical students is spread across the major stages in the six years of medical education in Germany: from freshmen and pre-clinical studies (first and second year), to clinical studies (third to fifth year), to the practical year in hospitals (sixth year). The study is part of a broader panel project with medical students, who participate in the longitudinal experiments up to four times in the course of their medical studies.

Following the literature (Andreoni and Miller, 2002; Fisman et al., 2007; Choi et al., 2007; Bruhin et al., 2019), we structurally estimate a constant elasticity of substitution (CES) utility function with two parameters, one capturing the altruism tradeoff and the other capturing the equality-efficiency tradeoff. The coefficients estimated using the sequence of binary choices allow us to infer the relative importance of different utility components, controlling for individual characteristics. Of particular interest here is the stage in medical studies. We also include other covariates in our analyses such as

socio-demographics, social and economic preferences according to Falk et al. (2018), personality traits (Rammstedt and John, 2007; Ashton and Lee, 2009), and stated occupational preferences, all of which are elicited through an extensive post-experimental questionnaire.

Our structural estimations show that, on average, medical students are altruistic in that they put a weight of two thirds on the patient benefit and only one third on their own profit. Medical education does have a significant effect on patient-regarding altruism. In particular, we find a U-shaped relationship between altruism and progress in medical education: compared to freshmen, medical students in the pre-clinical phase are more profit-oriented with the maximum profit orientation being observed during the clinical phase, after which altruism slightly increases again in the practical year. The analysis also shows that our medical subject pool is rather inequality averse. These effects are robust to a wide set of robustness checks controlling for medical students' gender, general altruism, other social and economic preferences, personality traits, and unobserved heterogeneity. Also, medical students' patient-regarding altruism is significantly higher than the one elicited among a control group of non-medical students.

We further link medical students' altruism to their future income expectations and to their stated specialty choices. We find that medical students' altruism is significantly linked to their specialty choices for pediatrics and surgery. Lower altruism, moreover, is significantly linked to higher future income expectations.

Our paper relates to several streams of the literature on measuring preferences among medical students and physicians. A first strand of empirical literature estimates altruism among primary care physicians using their prescription choices. Originating from Hellerstein (1998), the literature relies on a theoretical framework assuming that both the (indirect) utility of the patient and the insurance expenditures enter the utility function of the physician.[1] Within this framework, empirical studies compare physicians' marginal utility from patient welfare with their marginal disutility from insurance expenditures (e.g., Hellerstein, 1998; Lundin, 2000; Crea et al., 2019). Making use of prescriptions data on seven different drugs from two Swedish pharmacies in 1992 and 1993, Lundin (2000) estimates a random effects probit model for whether physicians prescribed the branded or generic version of the drugs and finds some support for physician altruism: higher coverage decreased (increased) the probability of prescribing a generic (branded) version of a drug. Using a national panel register containing all statins prescriptions in Finland from 2003 to 2010, Crea et al. (2019) estimate the likelihood that physicians prescribe generic versus branded versions of statins as a function of the shares of the difference between what patients have to pay out of their pocket and what is covered by the insurance. Estimated coefficients associated with altruism are nearly zero while Crea et al. (2019) find strong evidence of habit persistence in prescribing branded drugs.[2]

A second strand of literature focuses on health benefits of patients based on experimental economics methods. Compared to studies using medical prescriptions data, behavioral experiments allow

[1] Hellerstein (1998) assumes that the branded version of the drug is more expensive than the generic version. The model shows that, if the physician places a higher weight on the patient's utility than on insurance expenditures, an increase in the insurance coverage decreases (increases) the likelihood of the generic (branded) prescription. An increase in the insurance coverage, in fact, increases insurance expenditures and decreases patient's expenditures, *ceteris paribus*. As both these variables have a similar effect on the physician's utility, higher insurance coverage leads to a lower probability of generic prescribing when the physician values the utility of the patient more than the insurance expenditure.

[2] In this paper, we focus on physician altruism, and we do not consider studies on other healthcare providers like, for instance, Douven et al. (2019) who analyze the altruistic preferences of mental health workers using a large data set from the Netherlands. For a summary of other examples, see Galizzi et al. (2015).

to investigate the nature of patient-regarding altruism at an individual-subject level. This approach is theoretically guided by early formalizations of physicians' behavior by Arrow (1963) and Ellis and McGuire (1986), in which a physician's utility increases in the patient's health benefit. A prototypical early example is Hennig-Schmidt et al.'s (2011) medically framed laboratory experiment with a small sample of German medical students. Using data from this experiment, Godager and Wiesen (2013) estimate the marginal rate of substitution between patient benefit and profit as a measure of physician altruism. Their estimation results show patient-regarding altruism with substantial heterogeneity. Following Godager and Wiesen (2013), Wang et al. (2020) also estimate the distribution of altruism among 178 Chinese medical students and 99 Chinese physicians and compared it to those 42 German medical students participating in Hennig-Schmidt et al.'s (2011) experiment. Their estimates show that physician altruism is quite similar between Chinese doctors, Chinese medical students, and German medical students.

In a third strand of the literature, altruistic preferences of medical students are elicited experimentally in scenarios with no specific connection to a physician-patient relation. The standard experimental setting is a neutrally framed, modified dictator game where altruism is identified by the trade-off between self-interest and other's benefit. Following the seminal paper of Andreoni and Miller (2002), preferences over monetary sums are decomposed into two qualitatively different tradeoffs: a first tradeoff between self-interest and other's benefit, and a second tradeoff between equality and efficiency. In two related papers, Li et al. (2017) and Li (2018) use an online experiment to elicit altruistic preferences of 503 US medical students over distributing monetary sums between themselves and an anonymous other person. Both studies report widely heterogeneous social preferences in terms of their altruism and equality-efficiency trade-offs. Also, Li et al. (2017) report that medical students are similar in altruism, equality and efficiency preferences compared to non-medical student subjects in comparable samples but are substantially less altruistic and more efficiency-focused than a representative sample of US citizens.

The remainder of the paper is as follows. Section 2 provides some background on medical education in Germany and on our sample. In Section 3, we present our experimental design and procedure. Section 4 describes our econometric strategy for estimating the behavioral model's parameters at different levels of aggregation. Section 5 presents the behavioral results and the structural estimation results. Finally, Section 6 concludes.

2 Background and sample

2.1 Medical education in Germany

The vast majority of prospective physicians in Germany is educated at one of the 36 public medical schools (e.g., Zavlin et al., 2017). The admission to medical education is centralized nationally by the non-profit governmental Foundation for Admission to Higher Education (*Stiftung für Hochschulzulassung*), and is highly competitive, as only about one out of five applicants is admitted to a German medical school.[3] Admission criteria to medical schools, typically, are schools' grades according to the

[3]For example, in the winter term 2018/2019, according to the Stiftung für Hochschulzulassung 43,631 prospective students applied to study medicine in Germany while only 9,232 places were available.

General Certificate of Education (GCE), A-levels, waiting terms[4], and the applicants' performance in entry tests for studying medicine (TMS, *Test für Medizinische Studiengänge*). At the time of data collection, 20% of the available places at medical school were assigned to applicants with the best GCEs and to applicants based on accumulated waiting terms, respectively. The remaining places (60%) were allocated based on a medical school's individual selection criteria (e.g., TMS).[5]

The medical education in Germany is highly regulated. Structure, curriculum, and examination guidelines are standardized in the Medical Licensure Act (*Approbationsordnung für Ärzte*, ÄApprO, 2002) to ensure that all medical students obtain an appropriate and equivalent medical education.[6] Medical education lasts for at least six years and three months and concludes with the "Approbation", the official German license to practice as a physician, upon successfully passing the physician state exam (*Staatsexamen*). Along the different parts of the physician exam, medical education in Germany typically comprises three phases: (i) pre-clinical phase, (ii) clinical phase, and (iii) practical year.

In the first two years of the medical studies, the pre-clinical phase, students are taught the basics of medicine and natural sciences and take part in a nursing internship. Traditionally, the pre-clinical phase concludes with the first part of the physician exam. Instead of one final exam at the end, medical students in Cologne take separate tests at different times of the pre-clinical phase which serve as an equivalence to the first part of the state exam. The subsequent clinical phase comprises a minimum of three years. In this more practical phase all relevant clinical subjects are covered and students gain first experiences in practicing medicine as physician-interns in hospitals and outpatient settings prior to taking the second part of the physician exam. Medical education concludes with the practical year, the aim of which is to familiarize students with practical work in clinics. The students spend four months each at the hospital's department of internal medicine, the department of surgery, and an elective department different from internal medicine and surgery. After the practical year and having successfully completed the third part of the physician exam, medical students receive their license to practice medicine, and may start their actual specialization for a specific field in medicine.[7]

2.2 Our medical student sample

A total of 733 medical students of the University of Cologne participated in our study from April 2017 to December 2020. The sample consists of four groups of medical students: freshmen in the first week of their medical studies who did not get any prior medical education, and students from each of the three phases of medical studies (pre-clinical, clinical, and practical year). Table 1 provides an overview on the composition of our sample: freshmen 35.3%, pre-clinical 32.1%, clinical 21.6%, and practical year, 11.1%. 74% of the observations were collected in 2017 (summer and winter term) with the average response rate being 15%.[8]

[4]Based on their A-level and entry test scores at medical schools, applicants might need to wait for some terms before they are allowed to start studying medicine.

[5]In line with general guidelines implying a high weighting of GCE, every medical school can decide on applying their own selection criteria. At the University of Cologne, the internal selection is performed based on GCE (51%) and the applicants' performance in TMS (49%).

[6]Note that slight and predefined deviations from the standardized course of study are possible (§41 ÄApprO) due to the medical education at the University of Cologne being accredited as a so-called model course of study.

[7]The specialization requires further training in a chosen field of medicine, for example, neurology, pediatrics or surgery. The specialization lasts for another five to six years and takes place in university hospitals or other training clinics.

[8]For freshmen, pre-clinical, clinical, and practical year students response rates were 43%, 23%, 11%, and 4%, respectively, of those who were invited to participate in the study. We approached students at specific study terms, and,

Our sample consists of 440 (60%) females, the overall average age when starting medical education

Table 1: Sample composition by stages in studies

	Freshmen	Pre-clinical phase	Clinical phase	Practical year
Curriculum	First week of medical studies	Basic science, nursing internship	Clinical topics, internship as a physician	Practical work in hospital
Year(s) of studies	0	1-2	3-5	6
Medical student sample (N= 733)	259 35.3%	235 32.1%	158 21.6%	81 11.1%
Control group of non-medical students (N= 145)	40 27.6%	23 15.9%	56 38.6%	26[a] 17.9%

Notes. [a]6 years of studies and more

was 20.7, and the share of Germans by nationality is 92.5%. The sample composition is broadly representative of the medical student populations in Germany and at the University of Cologne in terms of gender, age, nationality, and admission quotas, see Table 2.

In addition to our sample of medical students, we study a control group of 145 non-medical students of different majors such as business administration, economics, politics, law, history, linguistics, literature, pedagogy, and natural sciences enrolled at the University of Cologne. The control group matches the medical student sample in terms of years of study, see Table 1.[9]

3 The experiment

3.1 General design and decision situation

We introduce a novel experimental task in a stylized medical frame to elicit patient-regarding altruism. $N = 733$ medical students each decide in the role of a physician (i) and face $J = 2$ treatment alternatives (referred to as "A" and "B" in the instructions) for 30 stylized "patients" ($T = 30$ choice occasions). Physician own profit (payment to self) is represented by s_{jt}, and o_{jt} represents the patient benefit (payment to other) for treatment alternative j and patient t. Henceforth, we use the labels "physician" and "patient" to indicate the roles in our experiment.

Physician profit as well as patient benefit are expressed in monetary terms. While all subjects in the experiment make decisions in the role of physicians for stylized patients, their choices in the experiment affect patients' health in the real world. In particular, following earlier controlled experiments on physician behavior, the monetary equivalent of the patient's benefit resulting from the treatment alternative

therefore, calculated the response rates based on the number of medical students in the respective study terms.

[9]Apart from medicine, study programs are generally organized as degree courses. The standard period of study is typically three for Bachelor degrees and two years for master degrees, respectively. The actual study duration at the University of Cologne is, however, about four years for Bachelor and about three years for Master degrees across all fields of study

Table 2: Our medical student sample in context

	Our total sample	Comparison for 2017		
		Germany[a]	University of Cologne[b]	Our sample[c]
Female (%)	60.0	61.5	61.7	61.0
Age at starting medical education[d]	20.7	19.5[e]	22.5[f]	21.2
Share of Germans (%)	92.5[g]	87.3	86.5[h]	92.6[i]
Admission quota[j]				
School-leaving grade (%)	21.8	20.0	20.0	21.9
Accumulated waiting terms (%)	9.9	20.0	20.0	10.3
University-specific selection criteria (%)	68.3	60.0	60.0	67.9

Notes. For the German student population descriptive statistics are only available for the winter term 2017/2018. Our sample comprises data from both the summer term and the winter term 2017 as the University of Cologne (UoC) is one of the few medical schools in Germany where students can enroll in both the summer and the winter term, and collecting our data started in April 2017. [a]German Federal Statistical Office (Statistisches Bundesamt, 2021). Data for the winter term 2017/2018: $n = 93,946$; [b]Summer term 2017 and winter term 2017/2018: $n = 6,034$; [c]Summer term 2017 and winter term 2017/2018: $n = 554$; [d]Freshmen only; [e]Data only available for average age of graduates (Statistisches Bundesamt, 2018). We, therefore, approximate the age at start of medical studies for overall Germany by subtracting the average study duration from the average age of graduates; [f]Data available only for summer term 2017: $n = 3,000$; [g]Due to missing data: $n = 657$; [h]Due to missing data: $n = 539$; [i]Due to missing data: $n = 539$; [j] The calculation of the admission quota is based on lower numbers than reported in Table 1, namely $n = 616$ for our total sample and $n = 507$ for the 2017 sample. Differences are due to procedural requirements in Germany, as some quotas are deducted from the total number of available places before allocating them to the applicants.

chosen is transferred to a charity and is earmarked for surgical treatment of cataract patients.[10] The treatment of a cataract patient costs about EUR 30. For procedural details, see Section 3.2.

Each of the 30 choice occasions implies a systematically varied trade-off between physician profit and patient benefit such that one treatment alternative is always more patient-regarding, see Table 3. The values for physician profit and patient benefit can take five values: EUR 3, 6, 9, 12, and 15.[11]

3.2 Experimental protocol

The recruitment procedure was as follows. Sessions with freshmen were conducted during the welcome week, just before the start of the academic year in the medical school. Besides freshmen, we approached pre-clinical students at the end of their first year or in their second year, clinical students in their fourth year, as well as practical-year students in their sixth year.

In total, we conducted 16 experimental sessions between April 2017 and December 2019. We run 11

[10]This procedure was introduced by Hennig-Schmidt et al. (2011) and has been applied in several experiments in health economics, as it embeds an incentive for subjects in the lab to account for real patients' health outside the lab. Equivalent mechanisms have been employed in recent behavioral experiments in health analyzing physician behavior (Hennig-Schmidt et al., 2011; Hennig-Schmidt and Wiesen, 2014; Godager et al., 2016; Brosig-Koch et al., 2016, 2017, 2020; Byambadalai et al., 2019; Di Guida et al., 2019; Martinsson and Persson, 2019; Huesmann et al., 2020; Wang et al., 2020; Waibel and Wiesen, 2021; Brosig-Koch et al., 2021). In Kesternich et al. (2015) and Lagarde and Blaauw (2017), subjects could choose from several (medical) charities to which a donation should be transferred.

[11]The specific values of the treatment alternatives were chosen to guarantee that participants' average earnings correspond to the hourly wage of a student assistant at the University of Cologne (EUR 10). We excluded values of zero to avoid end points. We used the command 'dcreate' in STATA 14.0 to guide the parameterization of our choice occasions (Hole, 2015). The computerized experiment was programmed in ILIAS, a free software used as online learning platform in German universities. Medical students in Cologne are familiar with ILIAS, as it is commonly used for surveys and tests. The 30 choice occasions were shown in a pre-determined randomized order on subjects' computer screens. A subject's total payoff consisted of a physician profit (from a randomly selected patient) and a lump-sum payment for filling in the post-experimental questionnaire (EUR 5).

Table 3: Physician profit and patient benefit for treatment alternatives A and B for the 30 patients

	Treatment A		Treatment B	
Patient t	Profit s_{At}	Benefit o_{At}	Profit s_{Bt}	Benefit o_{Bt}
1	3	15	6	9
2	3	15	9	9
3	3	15	15	3
4	3	15	6	6
5	9	15	12	12
6	6	9	15	3
7	15	3	6	9
8	3	15	6	3
9	3	15	12	6
10	9	9	3	15
11	3	9	9	3
12	15	3	3	15
13	3	15	12	12
14	3	12	12	3
15	6	12	9	6
16	3	9	6	6
17	12	12	15	9
18	3	12	15	3
19	9	6	3	12
20	6	6	3	15
21	12	12	3	15
22	12	3	3	9
23	15	6	6	12
24	6	3	3	6
25	3	9	15	3
26	6	9	3	15
27	6	9	9	6
28	15	6	9	12
29	15	9	9	15
30	6	12	15	3

laboratory sessions in a large lecture hall equipped with computer terminals at the medical school of the University of Cologne. The remaining five sessions were conducted online for a period of 10 to 26 days in order to reach students across all the different stages who were not able to participate in the laboratory sessions. We collected 457 (62.4%) observations via laboratory sessions and 276 (37.6%) observations via online sessions. Between November 2019 and January 2020, we run an online experiment with a control group of 145 non-medical students of the University of Cologne, who were recruited via the online recruiting system ORSEE (Greiner, 2015).

Prior to the experiment, subjects received detailed information on the data protection, the experimental decision task, the procedure and the payment process, and gave explicit consent to participate in the study. For more details, see the instructions provided in Appendix A.1. All subjects decided for the same 30 stylized patients. After subjects had taken their decisions, they were asked to complete a comprehensive questionnaire (see Section 3.3).[12]

It took subjects, on average, about 45 minutes to complete the decision tasks and the questionnaire.

[12]Questionnaire items, which were only applicable for medical students, were dropped for the non-medical students.

On average, medical students earned EUR 12.11 (profit EUR 7.11 plus EUR 5 for completing the questionnaire), and non-medical students were paid EUR 11.68 (profit EUR 7.68 plus EUR 4). The average patient benefit amounted to EUR 7.89 for medical and EUR 7.32 for non-medical students. In total, EUR 6,846 were transferred to the *Christoffel Blindenmission*, a charity that used the money exclusively for financing cataract surgery by their own ophthalmologist staff in developing countries. Our study, thus, enabled the treatment of 228 adult cataract patients at the cost for a surgery of EUR 30. The average patient benefit of EUR 7.80 subjects realize by their decisions is equivalent to one fourth of the total cost of an eyesight-restoring surgery .

3.3 Post-experimental questionnaire

A comprehensive endline questionnaire collected medical students' characteristics. In addition to the stage in medical studies and to standard demographics (gender, and age; recall Section 2.2), we collect information on subjects' personality traits, social and economic preferences, and future work-related preferences (e.g., preferred specialty and future income expectations).[13]

We elicited social and economic preferences through experimentally validated survey-based methods according to Falk et al. (2016, 2018). These comprise social preferences such as general altruism, trust, positive and negative reciprocity, and time and risk preferences. The measure for general altruism is of particular relevance here as it can be related to the incentivized patient-regarding altruistic choices. Additionally, we elicited subject's personality traits extraversion, agreeableness, conscientiousness, neuroticism/ emotionality, and openness using the 11-item short-version of the Big Five Inventory (Gosling et al., 2003; Rammstedt and John, 2007). From winter term 2018 onwards, we use the more detailed 60-item HEXACO Personality Inventory (Ashton and Lee, 2009).[14] For a detailed description of the questionnaire items, see Table A.1 in Appendix A.2.

4 Empirical strategy

4.1 Behavioral model of altruism

To structurally estimate altruism, we employ a behavioral model used in the previous literature (e.g., Andreoni and Miller, 2002; Choi et al., 2007; Fisman et al., 2007; Bruhin et al., 2019). As a utility function u_i for subject i we consider a constant elasticity of substitution (CES) parametric form, defined as:

$$u_i(s, o, a_i, r_i) = (a_i s^{r_i} + (1 - a_i) o^{r_i})^{\frac{1}{r_i}}, \tag{1}$$

where $a_i \in [0, 1]$ represents the weight a physician puts on her own profit, correspondingly $1 - a_i$ represents the weight a physician puts on the patient's health benefit, and $r_i < 1$ reflects the elasticity of substitution between own profit and the patient's health benefit. The elasticity of substitution is defined as $\sigma_i = \frac{1}{r_i - 1}$.

[13] As our study is part of a broader panel study, the post-experimental questionnaire also comprises several other questions which are not analyzed here.

[14] The HEXACO Personality Inventory elicits the same personality traits as the 11-item short-version Big Five Inventory, yet with 10 items each. As the additional trait honesty-humility is not included in the Big Five Inventory and, therefore, data is limited to 179 medical students, we neglect this trait in our subsequent analyses.

Depending on the values of a and r, subjects belong to different preference types. For example, a subject with a equal to one is a purely selfish type, because she does not put any weight on the patient's health benefit. (i) When $a \in (0.5, 1]$, the subject places more weight on own profit compared to the patient health benefit; (ii) when $a = 0.5$, the individual places the same weight on own profit and the patient's benefit; (iii) when $a \in [0, 0.5)$, the individual places less weight on own profit compared to the patient's benefit.

The parameter r reflects the curvature of the altruistic indifference curves. It ranges from $-\infty$ to 1: (i) when $r \in (0, 1]$, preference is weighted toward increasing the sum of own profit and patient benefit, with CES approaching a perfect-substitute utility function as $r \to 1$; (ii) when $r \in (-\infty, 0)$, the individual's distributional preference is instead weighted toward reducing the difference in own profit and patient benefit with CES approaching the Rawlsian or Leontief utility function $\min\{as, (1-a)o\}$ as $r \to -\infty$; (iii) when $r \to 0$, CES is approaching the Cobb-Douglas function $s^a o^{(1-a)}$, in which case the allocation to patient benefit o and physician s is constant.

4.2 Structural estimation

To estimate the parameters of this model, a and r, we apply McFadden's (1981) random utility model for discrete choices. In the experiment, N subjects faced $J = 2$ alternatives on $T = 30$ choice occasions (patients). We assume that subjects choose the alternative that maximizes their utility for each choice occasion. The random utility of subject i from choosing alternative j in a choice occasion (for a patient) t is defined as:

$$U_{ijt} = u_i(s_{jt}, o_{jt}) + \epsilon_{ijt}, \tag{2}$$

where $u_i(s_{jt}, o_{jt})$ is the deterministic utility of the allocation of own profit to the physician s_{jt} and the benefit to the patient o_{jt} and the error term is distributed extreme value. The choice probability between option $j = 1$ and option $j = 2$ for subject i in choice occasion t, can be written:

$$P_{it}(a_i, r_i, \mu_i) = \frac{1}{1 + e^{\frac{u_i(s_{1t}, o_{1t}, a_i, r_i) - u_i(s_{2t}, o_{2t}, a_i, r_i)}{\mu_i}}}.$$

Where $\mu_i > 0$ is a noise parameter with the following interpretation: when $\mu_i \to 0$ the choice becomes deterministic, when $\mu_i \to +\infty$ the choice becomes entirely random.

For the sake of simplicity, we denote $\theta_i = (a_i, r_i, \mu_i)$ the set of parameters for the CES preference functional. Let $y_{it} = 1$ if the subject chooses option $j = 2$ for choice t (and $y_{it} = 0$ otherwise), the likelihood associated with this choice is:

$$P_{it}(\theta_i)^{y_{it}}(1 - P_{it}(\theta_i))^{1-y_{it}}$$

and the likelihood associated with a choice sequence T for subject i with parameters θ_i, μ_i is written as:

$$P_i(\theta_i) = \prod_{t=1}^{T} P_{it}(\theta_i)^{y_{it}}(1 - P_{it}(\theta_i))^{1-y_{it}}.$$

We use a series of transformation functions to account for theoretical restrictions on parameters. First, the estimation procedures account for parameter constraints on noise with an exponential transformation ($\mu_i = g^{\mu}(\zeta_i^{\mu}) = exp(\zeta_i^{\mu})$) of the parameter value to guarantee the noise parameter is positive. For CES, the estimation procedures account for parameter constraints with transformation of the estimated parameter values ζ_i^a and ζ_i^r. For parameter a_i we use a logistic function ($a_i = g^a(\zeta_i^a) = \frac{1}{1+exp(-\zeta_i^a)}$) guaranteeing a_i, which is a share, is always between zero and one. For parameter r_i we use a translated negative exponential function ($r_i = g^r(\zeta_i^r) = 1 - exp(-\zeta_i^r)$), guaranteeing r_i is always lower than one. In vector notation, for the CES preference functional, $\theta_i = g(\zeta_i)$, with $\zeta_i = (\zeta_i^a, \zeta_i^r, \zeta_i^{\mu})$ and $g() = (g^a(), g^r(), g^{\mu}())$.

The regression tables in the main text (see Section 5) report the value of the transformed regression coefficients in preference parameters and noise, i.e. when regression coefficients are transformed back to the original scale. In other words, the constant is defined by $\theta_i = g(\zeta_i)$ and represents median parameters.

The first version of the random utility model pools the data and estimates aggregate parameters, a and r, that are representative for all subjects. These aggregate estimates represent the most parsimonious characterization of altruism.

For aggregate estimations, all individual share the same parameters: $\theta_i = \theta, \forall i$,

$$LL(\theta) = \sum_i ln(P_i(\theta)).$$

The estimation procedure maximizes the log-likelihood with respect to unconstrained parameters. The (grand) log-likelihood to be maximized with respect to ζ is:

$$LL(\zeta) = \sum_i ln(P_i(g(\zeta))).$$

Reported standard errors are clustered at the individual level and computed with the (multivariate) Delta method (see Appendix D.2 for details).

Aggregate estimations provide a parsimonious characterization of preferences but do not account for heterogeneity. In order to account for observed heterogeneity between participants we include several covariates in the structural estimation relating to the stage in medical studies, gender, preferences under risk, time preferences, social preferences and a series of personality measures. This defines six econometric models, each associated with a different set of covariates: Model (1) is the base model without covariates, Model (2) adds the different stages in medical studies as explanatory variables, Model (3) additionally includes gender as explanatory variable, Model (4) adds general altruism as explanatory variable, Model (5) further includes measures of risk aversion, discounting, trust, positive reciprocity and negative reciprocity as explanatory variables, and Model (6) adds personality measures as further explanatory variables.

More formally, let X_i denote the column vector of K regressors for individual i. The first element of X_i is a one. We denote η by the $3 \times (K+1)$ matrix of parameters such that:

$$\zeta_i = \eta X_i.$$

The (grand) log-likelihood to be maximized with respect to η is:

$$LL(\eta) = \sum_i ln(P_i(g(\eta X_i))).$$

The regression tables in the main text report the values of the preference and noise parameters when regression coefficients are transformed back to their original scale.[15]

5 Results

5.1 Descriptives and non-parametric analyses

To start with our analysis, we first focus on descriptive statistics and present non-parametric analyses. Table 4 shows the summary statistics for the proportion of patient-regarding choices (*prcs*, Panel A). The *prc* refers to the treatment alternative which provides the patient with the higher health benefit in each choice occasion. We also report summary statistics for subjects' characteristics (Panel B). Medical students decide in a patient-regarding way by, on average, taking 56.3% *prcs*. When differentiating between stages in medical studies, we find a U-shaped relationship. Freshmen are the most patient-regarding (66.0%). Patient orientation decreases in the pre-clinical phase (53.7%), reaches its minimum in the clinical phase (46.0%), and rises to 52.0% in the practical year.

Patient-regarding behavior of freshmen is significantly higher compared to students in the other stages of studies ($p < 0.001$, t-test). *prcs* in the pre-clinical phase are significantly higher than in the clinical phase ($p = 0.009$) but do not differ significantly between practical-year students and students in the pre-clinical or clinical phase ($p > 0.170$).

Figure 1 illustrates the distributions of *prcs* by stages in studies. Except for comparing clinical-phase and practical-year students, the Kolmogorov-Smirnoff test rejects the hypothesis of identical distributions for all stage comparisons ($p < 0.05$). Figure 1 also shows how medical students differ in their behavior. Pure profit-maximizers, who do not make any *prc*, are located at the bottom of the graphs – and for freshmen, this share is lowest (2.7%). In the pre-clinical phase, it amounts to 3.0% but increases to 15.8% in the clinical phase, while in the practical year decreasing again to 13.6%. On the other hand, the share of pure altruists, those always choosing the high-benefit alternative, is highest for freshmen (12.4%), while it is 4.3% in the pre-clinical phase, 7.0% in the clinical phase and 4.9% for practical year students.

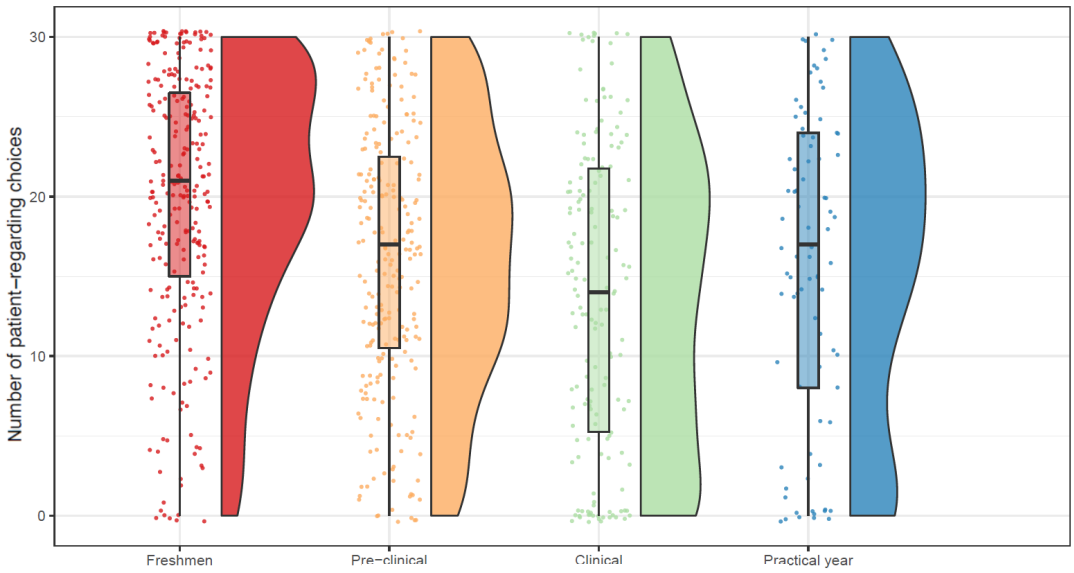
[15] In other words, the constants are defined by $\theta_0 = g(\eta_0)$ and represent median parameters. For the dummy variables, such as gender (or stage in medical studies), the tables with marginal effects report $g(\eta_0 + \eta_{female}) - g(\eta_0)$, the (partial) effect setting the female dummy to one. The same applies to the stages in medical studies. For preference parameters, distributed with a range of 1 (from -0.5 to 0.5 for risk aversion, with 0 indicating risk neutrality, from 1 to 0 for discounting, with 1 indicating no discounting and from 0 to 1 for other preference items), marginal effects are equal to $g(\eta_0 + \eta_{\text{preference item}} \times 0.1) - g(\eta_0)$. For personality measures, distributed over the support $[-1, 1]$, marginal effects are equal to $g(\eta_0 + \eta_{\text{personality item}} \times 0.2) - g(\eta_0)$. Standard errors are computed with the Delta method.

Table 4: Descriptive statistics of medical students' behavior and characteristics

	Mean M	s.d.	N
A. Patient-regarding choices			
Total sample	16.9 (56.3%)	9.0	733
Freshmen	19.8 (66.0%)	8.1	259
Pre-clinical	16.1 (53.7%)	8.3	235
Clinical	13.8 (46.0%)	9.6	158
Practical Year	15.6 (52.0%)	9.6	81
B. Characteristics			
Social and economic preferences			
Altruism	0.38	0.17	729
Trust	0.57	0.24	729
Positive reciprocity	0.36	0.18	729
Negative reciprocity	0.47	0.16	729
Risk aversion	0.07	0.15	731
Time discounting	0.27	0.16	731
Personality traits			
Agreeableness	0.09	0.37	729
Conscientiousness	0.39	0.35	729
Extraversion	0.25	0.41	729
Neuroticism/emotionality	-0.08	0.43	729
Openness	0.27	0.44	729

Notes. This table presents summary statistics on the number of patient-regarding choices and on subject's characteristics, the latter comprising social and economic preferences according to Falk et al. (2016; 2018), personality traits by the Big Five Inventory, (Gosling et al., 2003; Rammstedt and John, 2007) or the HEXACO Personality Inventory (Ashton and Lee, 2009). Altruism, trust, positive and negative reciprocity are measured on a $[0, 1]$-scale with 0 being the theoretical minimum and 1 the theoretical maximum. Risk aversion is transformed such that 0 implies risk neutrality, a positive value entails risk aversion and a negative value risk seeking. Time discounting being 0 entails patience, while a positive value implies impatience. All personality traits are measured on a $[-1, 1]$-scale. See Table A.1 in Appendix A.2 for a detailed description of all variables. The lower number of observations in Panel B is due to subjects leaving the survey before completing the questionnaire.

Figure 1: Distributions of patient-regarding choices by stages in studies



Notes. This figure shows distributions and box plots for number of patient-regarding choices by stages in studies. Pure profit-maximizers are located at the bottom of the graph and pure altruists at the top.

So far, our analysis provides evidence that the majority of medical students reveal preferences which are not purely profit-maximizing, and which attach some weight to patient benefits. By contrast, our control group of non-medical students is significantly less altruistic in all study stages. For further details on the choice behavior and descriptive statistics of our control group, see Appendix C.

We now turn to characteristics of the individual participants that were elicited in the questionnaire part of our study (see Section 3.3). Panel B in Table 4 shows the descriptive statistics on subjects' social and economic preferences (general altruism, trust, positive and negative reciprocity, risk, and time discounting) as well as on subjects' personality traits (agreeableness, conscientiousness, extraversion, neuroticism/emotionality, and openness).

Altruism, trust, positive and negative reciprocity are measured on a $[0, 1]$-scale with 0 being the theoretical minimum and 1 the theoretical maximum. Risk aversion is transformed such that 0 implies risk neutrality, a positive value entails risk aversion and a negative value risk seeking. Time discounting being 0 entails patience, while a positive value implies impatience.

For our medical student sample, the general altruism measure is $M_{altruism}$=0.38, which is below the theoretical midpoint of 0.50 and indicates that on the stated preference level, the students tend to be more selfish than altruistic. Our sample tends to be trusting (M_{trust} = 0.57), and is slightly more positively reciprocal than being negatively reciprocal ($M_{pos.recipr.}$=0.47, $M_{neg.recipr.}$=0.36). M_{risk}=0.07 points to a risk aversion of our participants, while the positive value for time discounting ($M_{timedisc.}$=0.26) indicates impatience.

All personality traits are measured on a $[-1, 1]$-scale. Regarding agreeableness and neuroticism/ emotionality, the sample means are close to the neutral midpoint ($M_{agr.}$=0.09 and $M_{neurot.}$=-0.08). The positive values for the remaining personality traits reveal that our students are rather conscientious,

extraverted, and open ($M_{conscient.}$=0.39, $M_{extrav.}$=0.25 and $M_{openn.}$=0.27).

5.2 Structural estimation with observed heterogeneity

Table 5 shows the estimation results with transformation of the estimated parameters into preference parameters, noise parameters, and marginal effects.[16] In our base model without covariates, a indicates a moderate profit orientation. Medical students put a weight of about one third on their own profit and two thirds on the patient health benefit. Parameter r is negative, implying that medical students express a tendency for inequity aversion; see Model (1) of Table 5.

Our estimation results support our non-parametric analyses. Medical students' patient-regarding altruism significantly declines with progress in medical education. Recall that a characterizes participants' own-profit orientation, and, thus, a negative (positive) coefficient for a implies an increase (decrease) in the weight subjects put on the patient benefit. Model (2) of Table 5 shows, that compared to freshmen (our reference category), the medical students in the pre-clinical phase are more profit-oriented and profit orientation is highest during the clinical study phase. Only in their practical year, medical students' patient-regarding altruism slightly increases again compared to the clinical studies. Figure 2 shows the typical indifference curves for the different stages in medical studies based on parameter estimates from Model (2). This effect of the study phase remains stable when controlling for medical students' gender, general altruism, other social and economic preferences, and personality traits; see Models (2) to (5) of Table 5. For an illustration of the heterogeneity implied by the different set of covariates, see Figure D.1 in Appendix D.1.

Our estimations show that female medical students are more altruistic towards patients than male medical students; see Model (3) of Table 5. We also observe that patient-regarding altruism is positively related to Falk et al.'s general altruism measure meaning that medical students with higher general altruism put significantly less weight on their own profit compared to the patient's health benefit. These findings are also robust when controlling for other social and economic preferences, as well as personality traits; see Models (4) to (6) of Table 5.

Overall, medical students reveal inequity averse preferences, as indicated by the estimates for the parameter r; see Model (1) of Table 5. Also, estimates for r tend to increase with progress in medical education but with no firm results when adding further controls to the regressions. Further, estimations show that women and individuals with higher general altruism have lower values of r; see Models (2) to (6) of Table 5. Noise μ tends to be lower for pre-clinical students and larger for students in practical years.

5.3 Robustness of results

We next test whether results are robust to different econometric models. One potential source of sensitivity is how the econometric model is extended to account for individual heterogeneity. This section provides a brief overview on alternative econometric approaches to account for individual heterogeneity. Details of each of these econometric models and the respective estimation results can be found in Appendices D.2 to D.4.

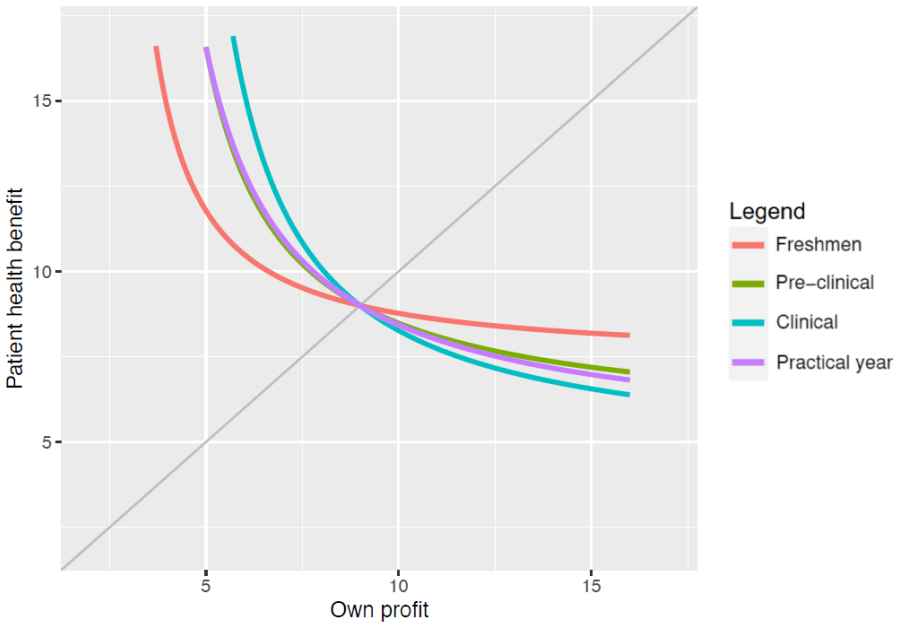
[16]The estimation results of the aggregate model without transformation of the estimated parameters are shown in Table D.1 of Appendix D.1.

Table 5: Aggregate estimations, preference parameters, noise and marginal effects, CES preferences

Model:	(1)	(2)	(3)	(4)	(5)	(6)
a						
Constant	0.339***	0.209***	0.293***	0.531*	0.708***	0.739***
	(0.016)	(0.024)	(0.035)	(0.052)	(0.090)	(0.109)
Pre-clinical		0.168***	0.163***	0.154***	0.095***	0.095***
		(0.035)	(0.041)	(0.048)	(0.047)	(0.051)
Clinical		0.258***	0.257***	0.213***	0.122***	0.124***
		(0.039)	(0.043)	(0.047)	(0.050)	(0.053)
Practical year		0.189***	0.138***	0.163***	0.075***	0.081***
		(0.056)	(0.084)	(0.070)	(0.068)	(0.064)
Female			−0.111***	−0.064***	−0.041***	−0.044***
			(0.023)	(0.031)	(0.027)	(0.040)
General altruism				−0.079***	−0.056***	−0.054***
				(0.011)	(0.013)	(0.018)
r						
Constant	−0.956***	−1.240***	−0.493***	−0.354***	−0.485***	−0.364***
	(0.097)	(0.137)	(0.168)	(0.197)	(0.423)	(0.489)
Pre-clinical		0.342*	0.149*	0.132**	0.181***	0.206***
		(0.218)	(0.189)	(0.167)	(0.218)	(0.232)
Clinical		0.393*	0.183	0.254***	0.276***	0.332***
		(0.273)	(0.240)	(0.188)	(0.245)	(0.240)
Practical year		0.486*	−0.092	0.100	−0.118	−0.014
		(0.376)	(0.477)	(0.341)	(0.545)	(0.524)
Female			−1.066***	−0.490***	−0.489***	−0.424***
			(0.205)	(0.186)	(0.243)	(0.272)
General altruism				−0.101***	−0.119***	−0.105***
				(0.028)	(0.063)	(0.073)
μ						
Constant	2.623***	2.519***	2.313***	2.247***	2.007***	1.951***
	(0.092)	(0.128)	(0.170)	(0.308)	(0.487)	(0.528)
Pre-clinical		−0.198	−0.171	−0.194**	−0.149*	−0.275***
		(0.194)	(0.217)	(0.224)	(0.212)	(0.254)
Clinical		0.041	0.112	−0.106	−0.075	−0.158*
		(0.265)	(0.307)	(0.286)	(0.266)	(0.279)
Practical year		0.373	0.787***	0.552***	0.951***	0.768***
		(0.363)	(0.650)	(0.572)	(0.691)	(0.741)
Female			0.127	−0.128	−0.064	−0.006
			(0.198)	(0.200)	(0.176)	(0.215)
General altruism				0.041*	0.026	0.017
				(0.048)	(0.054)	(0.055)
Soc./econ. preferences	No	No	No	No	Yes	Yes
Personality traits	No	No	No	No	No	Yes
N	733	733	733	729	729	729
Log-likelihood	-13,331.09	-13,002.64	-12,884.71	-12,394.66	-12,028.09	-11,997.39

Notes. This table shows the estimation results of the aggregate model for the CES preference functional with stage in studies, gender, and general altruism in the set of covariates. Model (5) and (6) control for social and economic preferences and Model (6) for personality traits to account for observed heterogeneity. For the estimates of the full list of covariates, see Table D.2 in Appendix D.1. Standard errors are clustered at the individual level. Differences in the number of observations in Models (4-6) is due to missing data on some questionnaire items. *p<0.10; **p<0.05; ***p<0.01.

Figure 2: Indifference curves for different stages in medical studies



Notes. This figure shows the indifference curves between own profit and patient health benefit for the different stages in studies based on CES preference parameter estimates from Model (2) of Table 5.

First, an alternative direction to account for heterogeneity identifies distinct preference (and noise) types with a finite mixture model without covariates. We estimated finite mixture models with three types ($C = 2, 3, 4$). These finite mixture models apply an endogenous classification procedure of distinct preference types and show that the heterogeneity in preferences types is substantial; for methodological details and estimation results, see Appendix D.2. This direction supports our econometric approach to account for (observed) heterogeneity in the aggregate estimation as the results support discrimination between purely altruistic and moderately strong social preferences.

Another potential direction to account for heterogeneity between subjects incorporates observed and unobserved heterogeneity in a random coefficient model. We use Bayesian methods for our estimations. The estimation results on our a parameter of Table D.7 in Appendix D.3 are consistent with those reported in Table 5 based on the aggregate estimation. This suggests that our findings of selfish preferences to increase with progressing in medical studies and with a maximum attained in the clinical phase are robust to estimating unobserved heterogeneity with a random coefficient model.[17]

Figure 3 shows a visual comparison between the distributions of observed versus unobserved heterogeneity for the preference parameters a and r and the noise parameter μ, when the full list of covariates is included.[18] The comparison of the two distributions shows that observed characteristics generate a

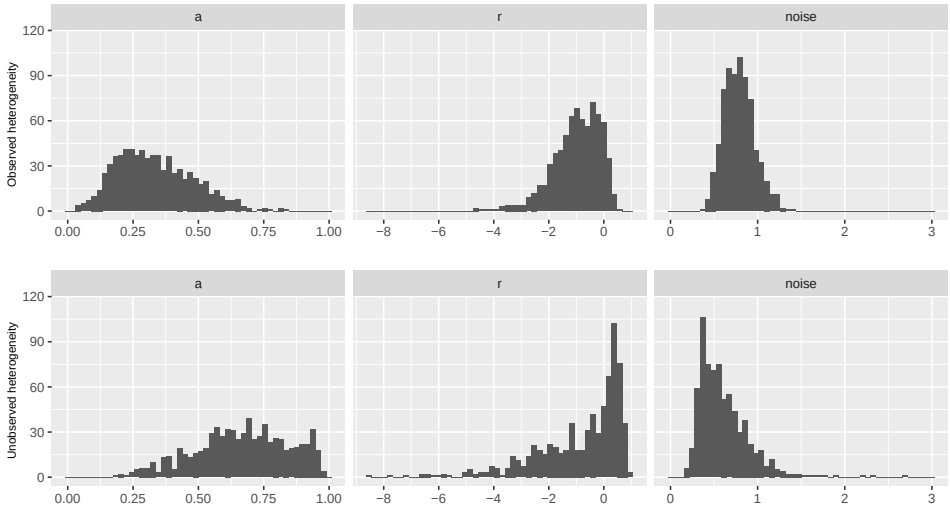
[17] Tables with a full list of all estimated parameters are provided in Appendix D.3, Table D.5 and Table D.7.

[18] Because histograms are based on non-linear transformations of estimated parameters and mean individual-level draws across iterations for observed versus unobserved heterogeneity, there is no natural comparison benchmark between each pair of distributions for noise and preference parameters.

rich variation in preference parameters a and r.

A last alternative is to estimate the preference and noise parameters for each individual separately.

Figure 3: Observed versus unobserved heterogeneity in the random coefficient model



Notes. This figure shows the distributions of individual preference and noise parameter based on CES preference parameter estimates from Model (6) with the random coefficient model. The top row represents observed heterogeneity, the bottom represents unobserved heterogeneity. Unobserved heterogeneity is based on transformed mean individual-level draws across iterations for the underlying multivariate normal distribution with all covariates equal to zero.

The summary statistics confirm that, on average, concerns for patients are higher than for own profit. In particular, the mean of the individual a estimates is close to the aggregate estimate. Table D.8 provides an overview of descriptive statistics for the individual parameter and preference estimates.

Our results may be sensitive to our choice of the structural model of altruistic preferences, the CES preference utility function. To examine the robustness of our findings to this potential sensitivity, we consider a Fehr and Schmidt (1999) parametric form as another variant for the utility function. The social preference model by Fehr and Schmidt captures preferences of disadvantageous and advantageous inequality through two distinct parameters; for more details on the behavioral model, see Appendix E.1. Overall, applying a Fehr and Schmidt preference functional supports our main findings that patient-regarding altruistic preferences decline with the progress of the medical studies, with the lowest altruistic preferences in students in the clinical study phase. Within the framework of the utility function, we find that our medical students are extremely averse to advantageous inequality, i.e., averse of them as physicians to be ahead of the patient, with clinical phase students being the least averse. At the same time, our medical student sample is also somewhat averse to disadvantageous inequality, with the highest aversion attained in clinical phase students. We provide results for the aggregate estimation in Appendix E.2 and for the random coefficient model in Appendix E.3.

Finally, we additionally perform all estimations including the control group of non-medical students. In Appendix D.5, we present all additional analyses for CES preferences in detail. The estimation re-

sults of each analysis are consistent with our presented main results. Further, we find that non-medical students behave less patient-regarding compared to medical students.

5.4 Patient-regarding altruism, income expectations, and specialty choices

Very little empirical evidence exists on the relationship between patient-regarding altruism and specialty choice or income expectations. We only know of Li (2018) who is analyzing this topic. For medical students in the US, she finds a negative association between experimentally measured general altruistic preferences and their stated intentions to choose high-income specialties after graduation. It is variants of surgery like neurological, cardiac and thoracic, orthopedic as well as plastic surgery that characterize high-income specialties, while psychiatry, pediatrics and family medicine belong to the low-income specialties.

When analyzing our data, we include medical students' individual income expectations and specialty choices directly in the list of covariates in our structural estimations. Income expectations are based on a subject's self-reported probabilities that his/her expected monthly net income falls into five different income categories.[19] When studying how individual altruistic preferences relate to specialty choices, the latter are not classified into income groups.

Overall, our medical student sample (N=693)[20] expects to earn on average EUR 4,427 net per month (s.d. 737), and a median of EUR 4,400. We split the continuous expected income variable at the median to facilitate the interpretation of our estimation results. In particular, the dummy variable "Expected income" in Table 6 equals 1 in case a medical student expects a future income above the median, and 0 otherwise. By adding the income variable to our previous models (see Section 5.2), we account for observed heterogeneity in expected income when estimating altruistic preferences. We find that the estimated preference parameter a is significantly higher for medical students with income expectations above the median (see left column of Panel A and B of Table 6) meaning that they put significantly more weight on their own profit than on the patient's health benefit.

We next study how altruistic preferences relate to the stated specialty choices. The four most frequently stated specialties are surgery (N= 137, 19%), internal medicine (N= 110, 15%), pediatrics (N= 97, 13%), and neurology/psychiatry (N= 84, 12%). The remaining specialties, each of which was chosen by less than 10% of our medical student sample, made up for 41% (N= 305).[21] Table 7 shows the estimation results of the aggregate estimation (Panel A) and the random coefficient model (Panel B). First, the effects of stages in studies, gender, and general altruism remain stable when controlling for specialty choices.[22] Second, altruism is linked to the preferences for specific specialties in that stating a preference for pediatrics or surgery relates to a significantly lower own-profit orientation a; see the left

[19] The five categories refer to the monthly net income of a full-time job five years after having completed the specialty education, and are as follows: (1) < EUR 3,000, (2) EUR 3,000 to 3,999, (3) EUR 4,000 to 4,999, (4) EUR 5,000 to 5,999, (5) > EUR 6,000. For each subject, we calculate an expected value for the future income expectations derived as the sum of the stated probabilities multiplied by the mean income of the respective category. In order to keep the range per category constant, we used EUR 2,500 and EUR 6,500 as average values for the lower and for the upper bound, respectively. When the sum of stated probabilities does not add up to 100 percent (for 82 observations), we transformed the scaling according to the probability sum.

[20] The lower number of observations is due to subjects leaving the survey before answering the question on their expected income.

[21] For the full list of specialties, see Table F.4 in Appendix F.

[22] The same holds for other social and economic preferences and personality traits included in the list of covariates but not explicitly reported in Table 7. The respective estimates are shown in Table F.5 and Table F.6 in Appendix F.

Table 6: Aggregate estimations and random coefficient model, preference parameters, noise and marginal effects, CES preferences, expected income

	A. Aggregate estimation			**B. Random coefficient model**		
	a	r	μ	a	r	μ
Constant	0.798^{***}	0.081	1.441^{***}	0.618^{***}	-0.105	0.587^{***}
	(0.112)	(0.393)	(0.371)	(0.085)	(0.244)	(0.116)
Expected income	0.040^{***}	0.040	0.201^{***}	0.015^{***}	0.024	-0.006
	(0.021)	(0.115)	(0.179)	(0.006)	(0.017)	(0.025)
Pre-clinical	0.073^{***}	0.076^{*}	-0.123^{**}	0.109^{***}	-0.006	0.006
	(0.053)	(0.168)	(0.185)	(0.033)	(0.017)	(0.029)
Clinical	0.094^{***}	0.149^{***}	-0.052	0.155^{***}	0.028	-0.077^{**}
	(0.057)	(0.195)	(0.212)	(0.039)	(0.019)	(0.037)
Practical year	0.082^{***}	0.183^{***}	0.151	0.146^{***}	0.056^{*}	-0.051
	(0.055)	(0.245)	(0.372)	(0.045)	(0.030)	(0.034)
Female	-0.035^{***}	-0.347^{***}	0.070	-0.021	-0.058^{***}	0.070^{*}
	(0.038)	(0.256)	(0.202)	(0.019)	(0.021)	(0.038)
General altruism	-0.041^{***}	-0.049^{***}	-0.005	-0.044^{***}	-0.091	0.173
	(0.025)	(0.066)	(0.050)	(0.010)	(0.055)	(0.123)
N	693	693	693	693	693	693
Log-likelihood	-11,276.86	-11,276.86	-11,276.86	-5,216.73	-5,216.73	-5,216.73

Notes. This table shows the estimation results of the aggregate model and the random coefficient model for the CES preference functional with an expected income variable (=1 if expected income is above the median, =0 otherwise), stage in studies, gender, and general altruism in the set of covariates. The model also includes risk, time and social preferences and personality traits as covariates to account for observed heterogeneity. For the estimation results with the full list of covariates, see Tables F.1 - F.3 in Appendix F. Standard errors are clustered at the individual level. The lower number of observations compared to the full sample of $N = 733$ is due to missing answers to the expected income question. *p<0.10; **p<0.05; ***p<0.01.

column of Panel A. The random coefficient model shows that lower profit orientation is linked to the likelihood of stating a preference for pediatrics; see the left column of Panel B.

Table 7: Aggregate estimations and random coefficient model, preference parameters, noise and marginal effects, CES preferences

	A. Aggregate estimation			**B. Random coefficient model**		
	a	r	μ	a	r	μ
Constant	0.757^{***}	-0.462^{***}	2.157^{***}	0.612^{***}	-0.658^{*}	0.664^{***}
	(0.124)	(0.613)	(0.624)	(0.055)	(0.388)	(0.088)
Surgery	-0.027^{**}	0.069	-0.254^{***}	-0.009^{*}	-0.014	0.017
	(0.050)	(0.215)	(0.243)	(0.005)	(0.019)	(0.025)
Internal medicine	-0.010	0.201^{***}	-0.536^{***}	-0.017	-0.028	0.004
	(0.031)	(0.187)	(0.234)	(0.011)	(0.029)	(0.029)
Pediatrics	-0.032^{***}	0.298^{***}	-0.464^{***}	-0.015^{***}	0.007	-0.035
	(0.041)	(0.267)	(0.271)	(0.005)	(0.015)	(0.026)
Neurology/psychiatry	-0.020^{*}	0.317^{***}	-0.182	-0.006	0.015	-0.066^{*}
	(0.052)	(0.272)	(0.312)	(0.008)	(0.015)	(0.035)
Pre-clinical	0.083^{***}	0.145^{**}	-0.279^{***}	0.110^{***}	0.002	-0.0001
	(0.048)	(0.263)	(0.290)	(0.020)	(0.015)	(0.026)
Clinical	0.113^{***}	0.307^{***}	-0.159	0.168^{***}	0.038^{**}	-0.086^{***}
	(0.051)	(0.256)	(0.308)	(0.021)	(0.017)	(0.032)
Practical year	0.062^{***}	-0.084	0.834^{***}	0.135^{***}	0.054^{***}	-0.024
	(0.071)	(0.725)	(0.910)	(0.024)	(0.019)	(0.033)
Female	-0.049^{***}	-0.489^{***}	0.013	-0.050^{**}	-0.074^{***}	0.069^{**}
	(0.041)	(0.335)	(0.260)	(0.022)	(0.026)	(0.030)
General altruism	-0.053^{***}	-0.129^{***}	0.028	-0.043^{***}	-0.053	0.152
	(0.021)	(0.098)	(0.064)	(0.010)	(0.042)	(0.115)
N	729	729	729	729	729	729
Log-likelihood	-11,931.48	-11,931.48	-11,931.48	-5,522.58	-5,522.58	-5,522.58

Notes. This table shows the estimation results of the aggregate model and the random coefficient model for the CES preference functional with occupational choices, stage in studies, gender, and general altruism in the set of covariates. The model also includes other social and economic preferences and personality traits as covariates to account for observed heterogeneity. The lower number of observations compared to the full sample of $N = 733$ is due to subjects leaving the survey before completing the questionnaire. For the results of the full list of covariates, see Tables F.5 - F.7 in Appendix F. Standard errors are clustered at the individual level. *p<0.10; **p<0.05; ***p<0.01

6 Discussion and conclusion

We measure and structurally estimate *patient-regarding* altruistic preferences of future physicians. Introducing a novel medically framed experimental design, we measure the trade-offs between own profits and the patient health benefits for a large sample of medical students (N= 733). We find that medical students are altruistic in that on average they put a weight of about two thirds on the patient health benefit and only one third on their own profit.

Medical education forms medical students' altruistic preferences. Altruism is highest when students enter the medical school and significantly declines over the stages in medical studies. Only in the practical year at the end of the medical education, patient-regarding altruism slightly increases again. Compared to non-medical students, medical students behave more altruistically towards patients already when beginning their studies, suggesting that altruistic motives play an important role

in the decision to enter medical school. The difference in altruistic motivations between medical and non-medical students is in line with findings from other experimental studies (e.g., Hennig-Schmidt and Wiesen, 2014; Brosig-Koch et al., 2016; Li et al., 2021).

Our findings on the formation of physician altruism through medical education are robust to using a range of different structural models of altruistic preferences. Using both the CES preference utility function and the Fehr and Schmidt (1999) preference functional, all the structural estimations show that medical students exhibit a high aversion to advantageous inequality. Thus, prospective physicians in our experiment appear to dislike choosing a treatment that provides them with a profit higher than the patient's health benefit. Our data also show that patient-regarding altruism is linked to students' characteristics, general social preferences, income expectations, and specialty choices. Female medical students and students scoring higher in general altruism put significantly more weight on the patient's health benefit compared to their own profit. Less profit-oriented medical students expect to earn a lower income when practicing as a physician in the future. Finally, students who put a higher weight on the patient's health benefit are more likely to choose pediatrics and surgery as their preferred specialties.

Our result on the strong altruism of medical students differs from estimates reported in related studies (Li et al., 2017; Li, 2018; Li et al., 2021). While in Li (2018), US medical students put, on average, a weight of about two thirds on their own payoff and only one third on the payoff of an anonymous non-specified individual person, the distribution of weights on own payoff and patient benefit in our study is the opposite. This marked difference may be caused by differences between the two samples (e.g. US vs. German medical students) but also by the different features in the experimental designs. Medical students in Li (2018) are confronted with a neutrally framed dictator game where the medical context is not made salient to the participants. Moreover, receivers of the medical students' money are individuals randomly chosen from a representative American Life Panel, with the health needs of the receiver not being made salient. In our study we deviate from a neutral dictator game and develop a task specifically designed to capture the medical environment prospective physicians are confronted with. Our framing includes physicians and patients, and the monetary equivalent of the patient benefit is used for patients in need of cataract surgery outside the laboratory to regain their eyesight. Making the physician-patient relationship and the health benefit salient, could potentially explain the evidence on strong altruism found in our pool.

The decrease in patient-regarding altruism during the medical education may be explained by a kind of disillusionment of the medical students. When increasingly working in clinics and healthcare institutions, students might realize a discrepancy between their own expectations and the professional reality. Moreover, medical education follows a rather strict, predefined curriculum up to the practical year. In the more theoretically oriented phases of medical education, patients might be considered as abstract "learning objects". The educational focus in the practical year, however, relies on close interaction with real patients that, in turn, might reactivate the ideals and expectations students had before entering the medical school. It can also be argued that practical year students who are commonly paid a financial compensation for their work as a full time employee in the hospital have a higher disposable income which may induce them to spend more money on financing patients' cataract surgery. However, our survey data reveals that the average income of medical students does not significantly differ be-

tween students in the different stages in studies.[23] The increase in patient-regarding altruism observed in practical year students may also be explained by a compensating effect that tries to counterbalance the focus of hospitals on generating profit by increased altruism. Finally, these final-year students, who are about to graduate, represent a particularly selected sample as they have successfully mastered the highest hurdles in medical education in Germany, namely the first and second parts of the state exam (at the end of the pre-clinical and clinical stages, respectively). Testing such a selection effect will require a panel design repeatedly observing the same respondents throughout the course of their medical education.

To overcome the decrease in patient-regarding altruism, one may think of several measures. In Germany, for instance, guidelines for medical education require medical schools to set courses and learning objectives dedicated to the physicians' role. The role of altruism is a key aspect of patient-doctor communication and, as such, it could be included in medical students' curriculum as advocated in the UK (Wicks et al., 2011), in Australia and other countries; see, for instance, Lowe et al. (2001); Ziv et al. (2008); Adam et al. (2012). In a similar vein, the Medical German Association recommends that medical attitudes, ethical behavior and social skills need to be taught during the education of future physicians (Bundesärztekammer, 2020). Also, exposing medical students to clinical work earlier in their studies, and thus increasing their interaction with patients could further enhance the increase in patient-regarding altruism observed in the practical year.

Our study is not without limitation. For one thing, although we compare estimates for medical students with corresponding data for a control group of non-medical students, we are not able to fully disentangle the estimated effects of the different stages in medical education from cohort effects. Also, although results are robust across several alternative specifications, our finding that less profit-oriented medical students expect to earn less when practicing as a physician could be sensitive to the way we constructed the expected income variable.

Notwithstanding these possible limitations, our study provides some new evidence and original insights. From a policy perspective, the link between medical students' patient-regarding altruism and their occupational choices is important. First, it can inform the discussion about the design of appropriate financial incentives for physicians and other healthcare professionals (e.g., Ashraf et al., 2014a,b; Ashraf and Bandiera, 2017; Lagarde and Blaauw, 2017; Deserranno, 2019; Ashraf et al., 2020; Wagner et al., 2020). Second, it may also explain some of the key labor market decisions by future physicians. For example, our results can also inform the ongoing policy debate about the trends and determinants of physician shortages. Recent projections on dramatic physician shortages in Western countries reveal high variations across specialties.[24] These do not account for potential COVID-19-related impacts which are likely to exacerbate the problem. More generally, empirical evidence to date is not fully

[23] On average, medical students report a monthly income of EUR 465 (s.d. 401) with minor differences in the stages of their studies: EUR 458 (s.d. 397), EUR 491 (s.d. 413), EUR 423 (s.d. 379), and EUR 499 (s.d. 423) for freshmen, pre-clinical phase, clinical phase, and practical year students, respectively. Comparisons based on two-sided t-tests reveal no significant differences between the means with p-values ≥ 0.155. Due to missing data the income analyses are restricted to 486 medical students of our sample.

[24] In the UK, the highest shortages are expected in psychiatry, general medicine and emergency (Taylor, 2020; British Medical Association, 2021) while in the US, this is in primary care, and surgery (Association of American Medical Colleges, 2021). Also in Germany, projections vary massively by specialty. For surgery as well as for general medicine nearly half of the current positions are expected filled in the future, and thus every second position would to remain vacant in the future. In contrast, about 77% more practical-year students want to become pediatricians than there are positions to fill (Jacob et al., 2019).

conclusive on which factors are influential for selecting a particular specialty and on the impact of medical students' preferences therein. The literature has already identified several factors that can possibly influence specialty choice by physicians.[25] Our study contributes to this literature, by suggesting that specialty choices are related to another key factor, which is formed in the course of the medical education: physicians' altruistic preferences towards their patients.

[25]These are, for instance, expected income (Bazzoli, 1985; McKay, 1990; Nicholson, 2002; Thornton and Esposto, 2003; Gagné and Léger, 2005), non-monetary factors such as expected working hours (McKay, 1990), regular working schedules (Thornton and Esposto, 2003), Dorsey et al., 2003), intellectual content (Harris et al., 2005), and procedural work or academic opportunities (Sivey et al., 2012).

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A Additional information about the experiment

A.1 Instructions of the experiment

Translated from German, lab version [online version]

Experimental study of the Faculty of Medicine and the Faculty of Management, Economics and Social Sciences at the University of Cologne

Thank you for your willingness to participate in our research study in cooperation between the Faculty of Medicine and Faculty of Management, Economics and Social Sciences at the University of Cologne.

In particular, you are participating in a study on decision-making behavior in the context of experimental economic research. The aim of the study is to gain insights into the behavioral mechanisms and determinants of individual decisions. Overall, the study—consisting of a decision-making experiment and a subsequent questionnaire—will take about 45 minutes of your time.

During the experiment, you and the other participants will be asked to make decisions. You can earn money in the course of the experiment. The amount of your earnings depends on your decisions.

You will also be asked to answer a series of questions. As compensation for answering the questionnaire, you will receive an additional fixed amount of €5.

After having completed the questionnaire, all your earnings from the experiment and the questionnaire will be paid to you in cash. [After completion, all your earnings from the experiment and from the questionnaire will be paid to you in cash.]

With your decisions in the experiment, you determine the amount of your own earnings as well as the benefit for a patient. There are no patients present during the experiment, but the patient benefit resulting from your decisions (expressed in Euro) will be transferred to the charitable organization *Christoffel Blindenmission Deutschland e.V.*, 64625 Bensheim. They spend the amount exclusively on the treatment of patients with cataracts (an eye disease).

Your participation is voluntary. During the experiment and while filling in the questionnaire, you can interrupt or withdraw from participation at any time without giving reasons and without facing any negative consequences for your person.

During the course of your medical studies, we will ask you again to participate in our study. The success of our research project depends on your regular participation. We would like to include about 80% of your semester students in this study.

The data generated from the experiment and from the questionnaire are analyzed pseudonymously. The data cannot be matched to any specific person. Third parties have no access to the data. The pseudonymous data will be used for scientific research and presentations. This work will be published. Study results are not used commercially. Before starting the experiment, we ask you to generate an individual code on your computer. No conclusions about your person can be drawn from this code. This also applies in the case of publication of the study results. The code serves only as a pseudonym,

through which your individual data from several participations can be compiled. The code also serves for the anonymous payment of the earnings from the experiment. The 6-digit code consists of the first letter of your place of birth, the second letter of your mother's first name, the second letter of your own first name, the first letter of your father's first name, and your day of birth (in two digits).

A data custodian is responsible for storing and managing the data generated from the experiment. The data custodian is independent of the research project and is the only person who has access to the entire data set, which—in addition to the data collected in the experiment and questionnaire—contains your personal code and student number. The data custodian does not perform any data analyses and ensures that the people involved in the project receive only the data and the pseudonyms, which are collected in the experiment. This ensures that no conclusions can be drawn from the data about individual persons. The data set containing the participants' pseudonyms and student numbers will be destroyed after completion of the project (after 6 years). You have the option (without restriction) to revoke your consent to data processing. There is the possibility of viewing the original data through the Ethics Commission. You have the right to information and rectification regarding the data stored about you. It is possible to delete personal data.

Contact:
Prof. Dr. Daniel Wiesen
Department of Business Administration and Health Care Management, University of Cologne
Universitätsstraße 91, 50931 Cologne
Tel. + 49 (0) 221 470 89 171
wiesen@wiso.uni-koeln.de

The study was approved by the Ethics Commission of the Faculty of Medicine of the University of Cologne.

[Declaration of consent] *(In the lab, the consent form was handed out and signed by participants.)*

I have read and understood the information about participation in the experimental study, including the information concerning data security. I know that my participation is voluntary and that I can revoke my consent to participate at any time without suffering any negative consequences for my person.

☐ I declare my consent for participation and want to participate
☐ I do not want to participate

Generation of the 6-digit code:

To link your answers from different surveys, we would like to ask you to enter the five pieces of information indicated below, in order to generate your personal code. No conclusions about your person can be drawn from this code. It serves solely as a pseudonym, through which your answers to different surveys can be linked. Furthermore, the code allows the anonymous payment of the earnings from the experiment.

(Notes. If you have umlauts in your name, please enter them as such (e.g., ä not ae). Please use lower case letters.)

o First letter of your place of birth
o Second letter of your mother's first name
o Second letter of your own first name
o First letter of your father's first name
Answer: _ _ _ _

(Notes. Please do not enter more letters than the maximum of 4. Any letters exceeding this maximum will be deleted automatically.)

Your day of birth (in two digits)
Answer: _ _ _ _

Generation of the 6-digit code:

To confirm, please re-enter your personal code:

(Notes. If you have umlauts in your name, please enter them as such (e.g., ä not ae). Please use lower case letters.)

o First letter of your place of birth
o Second letter of your mother's first name
o Second letter of your own first name
o First letter of your father's first name
Answer: _ _ _ _

(Notes. Please do not enter more letters than the maximum of 4. Any letters exceeding this maximum will be deleted automatically.)

Your day of birth (in two digits)
Answer: _ _ _ _

Welcome to our decision-making experiment!

Description of the experiment

You are participating in a study on decision-making behavior in the context of experimental economic research. During the experiment, you and the other participants will be asked to make decisions. You can earn money in the course of the experiment. The amount of your earnings depends on your decisions. Please carefully read through the following description of the experiment. *If you have questions regarding the description or during the experiment, you can signal this by raising your hand at any time. We will come to you and answer your questions personally.*

For the entire duration of the session, it is not allowed to communicate with other participants. If you violate this rule, you will be excluded from the experiment and will not receive any payment.

Please make sure that your mobile phones are switched off and that they are put in the corridor along with your bags and jackets if applicable. From there, you can pick up your belongings when you are finished. [While you are doing the experiment, we would like to ask you not to use any auxiliary devices (internet, cell phone, ...) and not to communicate with the others.]

The experiment comprises 30 rounds.

During the entire experiment you take the role of a physician. In each round, you decide on the treatment of a patient.

For each patient, you choose between two treatment options—Treatment A or Treatment B. With your decision, you determine your earnings in Euros and the benefit for the patient, which is also measured in Euros.

Upon completion of the experiment one of the 30 rounds of the experiment will be randomly selected. The earnings from that round will be paid to you in cash after the completion of the experiment and the questionnaire.

No There are no patients will be present in this during the experiment (or and no participants in take the role of patients). The patient benefit in Euros, which is determined by from your decision in the randomly selected round, will help an actual patient: the amount of money resulting from the patient benefit you generated with your decision regarding the benefit for a patient will be given donated to the charitable organization Christoffel Blindenmission Deutschland e.V., 64265 Bensheim. The amount is earmarked to facilitate the treatment of patients with cataracts (an eye disease).

☐ I have understood the instructions.

Payment

Information concerning place and time of the payment will be given to you after the completion of the experiment. *(Additionally, an information sheet was handed out to the participants)*

You will receive your payment in an envelope with your personal code on it. To guarantee anonymized payment, you will confirm on a separate receipt with your signature that you have received your payment according to your code. The code is not listed on this separate receipt sheet. Once signed, please put the receipt sheet without the envelope in the provided box.

After the experiment, the proper payment of the amount to the *Christoffel Blindenmission Deutschland e.V.* will be confirmed by a control person. When receiving her payment, the control person will enter the amount of money, which results from the cumulated patient benefit generated in the randomly selected round, in a payment order form. The form will be put in a stamped envelope addressed to the financial administration of the University of Cologne. The control person and another person involved in the study will then together put it into the nearest mailbox. The financial administration of the University of Cologne will then issue the payment of this amount to *Christoffel Blindenmission Deutschland e.V.*.

The role of the control person will be randomly assigned to a participant upon completion of the questionnaire [today]. The control person will receive an additional remuneration of 5€ next to the payment she receives from the experiment and the questionnaire. On a form, the control person will confirm with her signature that she has correctly completed her assigned tasks as described above. A copy of this form as well as a copy of the confirmation of *Christoffel Blindenmission Deutschland e.V.*, indicating the receipt of payment, will be hung up in the information box of the Deanery of Studies of the Faculty of Medicine at Cologne University (Basement, Building 42, Joseph-Stelzmann-Str. 20, 50931 Cologne).

☐ I have read and understood the information regarding payment.

Sample decision situation in the experiment

We would now like to explain the decision situation in the experiment using an exemplary decision screen. Both treatment options Treatment A and Treatment B are simply depicted in an abstract manner, without indicating actual medical services. The selection of a treatment option (either Treatment A or Treatment B) determines the profit of the physician as well as the benefit for the patient.

	A	B
Your profit (in €)	7	14
Patient's benefit (in €)	10	2
Your decision:	○ Treatment A	○ Treatment B

The interpretation of the screen above is as follows: Suppose a participant has chosen Treatment A. Then the earnings of the participant amounts to 7 and the benefit for the patient amounts to 10. If a participant decides on Treatment B, her earnings (in €) amount to 14 and the benefit for the patient (in €) amounts to 2. You choose your preferred treatment option (either Treatment A or Treatment B) by clicking on it.

☐ I have read and understood the information regarding payment.

A.2 Summary of the survey items

Table A.1: Description of survey items

Variable	Description	Scale
Social and economic preferences (Falk et al., 2018, 2016)		
Risk aversion	Equality weighted sum of quantitative and qualitative measure and transformed such that = 0 implies risk neutrality, > 0 risk aversion, and < 0 risk seeking.	[-0.5, 0.5]
Quantitative item	Switching point in multiple price list (31 hypothetical choices between a lottery and a safe option), rescaled to [0, 1].	
Qualitative item	Self-assessed risk taking on a scale from 0 ("not at all willing to take risks") to 10 ("very willing to take risks"), , rescaled to [0, 1].	
Time discounting	Equality weighted sum of quantitative and qualitative measure and transformed such that = 0 implies patience, and > 0 impatience.	[0, 1]
Quantitative item	Switching point in a list of 25 hypothetical choices between an early payment "today" and a delayed payment "in 12 months", rescaled to [0, 1].	
Qualitative item	Self-assessed patience on a scale from 0 ("not at all willing to give up something today [in order to benefit from that in the future]" to 10 ("very willing to give up something"), rescaled to [0, 1].	
Trust	Equality weighted sum of quantitative and qualitative measure.	[0, 1]
Quantitative item	First mover behavior in hypothetical investment game, rescaled to [0, 1].	
Qualitative item	Self-assessment on how much the statement "As long as I am not convinced otherwise, I assume that people have only the best intentions" describe subjects on a scale from 0 ("does not describe me at all") to 10 ("describes me very well"), rescaled to [0, 1].	
Altruism	Equality weighted sum of quantitative and qualitative measure.	[0, 1]
Quantitative item	Donation to a good cause after hypothetical lottery win of 1000 Euro, rescaled to [0, 1].	
Qualitative item	Self-assessed altruism on a scale from 0 ("not at all willing to share [with others without expecting anything in return when it comes to a good cause]" to 10 ("very willing to share"), rescaled to [0, 1].	
Positive reciprocity	Equality weighted sum of two quantitative measures.	[0, 1]
Quantitative item 1	Second mover behavior in hypothetical investment game (average of four scenarios), rescaled to [0, 1].	
Quantitative item 2	Size of thank-you gift following hypothetical scenario, rescaled to [0, 1].	
Negative reciprocity	Equality weighted sum of quantitative and qualitative measure.	[0, 1]
Quantitative item	Minimum acceptable offer in hypothetical ultimatum game, rescaled to [0, 1].	
Qualitative item	Self-assessed negative reciprocity on a scale from 0 ("not at all willing to punish [unfair behavior even if it is costly]") to 10 ("very willing to punish"), rescaled to [0, 1].	
Personality traits		

Continued on next page

Variable	Description	Scale
	Self-assessed description of personality according to following items (either Big Five Inventory by Rammstedt and John (2007), Gosling et al. (2003) or HEXACO Personality Inventory by Ashton and Lee (2009). For each trait, we calculated the average score of the respective items and rescaled it to [-1, 1].	
Openness(to experience)		[-1, 1]
Big Five	On a scale from 1[Disagree strongly] to 7[Agree strongly]: "I see myself as someone who has few artistic interests.(reverse code)", "I see myself as someone who has an active imagination."	
HEXACO	On a scale from 1[Disagree strongly] to 5[Agree strongly]: "I would be quite bored by a visit to an art gallery.(reversed code)", "I'm interested in learning about the history and politics of other countries.", "I would enjoy creating a work of art, such as a novel, a song, or a painting.", "I think that paying attention to radical ideas is a waste of time.(reverse code)", "If I had the opportunity, I would like to attend a classical music concert.", "I've never really enjoyed looking through an encyclopedia.(reverse code)", "People have often told me that I have a good imagination.", "I like people who have unconventional views.", "I don't think of myself as the artistic or creative type. (reverse code)", "I find it boring to discuss philosophy.(reverse code)".	
Conscientiousness		[-1, 1]
Big Five	On a scale from 1[Disagree strongly] to 7[Agree strongly]: "I see myself as someone who tends to be lazy.(reverse code)", "I see myself as someone who does a thorough job.".	
HEXACO	On a scale from 1[Disagree strongly] to 5[Agree strongly]: "I plan ahead and organize things, to avoid scrambling at the last minute.", "I often push myself very hard when trying to achieve a goal.", "When working on something, I don't pay much attention to small details.(reverse code)", "I make decisions based on the feeling of the moment rather than on careful thought.(reverse code)", "When working, I sometimes have difficulties due to being disorganized.(reverse code)", "I do only the minimum amount of work needed to get by.(reverse code)", "I always try to be accurate in my work, even at the expense of time.", "I make a lot of mistakes because I don't think before I act.(reverse code)", "People often call me a perfectionist.", "I prefer to do whatever comes to mind, rather than stick to a plan.(reverse code)".	
Agreeableness (versus Anger)		[-1, 1]
Big Five	On a scale from 1[Disagree strongly] to 7[Agree strongly]: "I see myself as someone who tends to find fault with others.(reverse code)", "I see myself as someone who is generally trusting.", "I see myself as someone who is considerate and kind to almost everyone.(additional)"; rescaled to [-1, 1].	

Continued on next page

Variable	Description	Scale
HEXACO	On a scale from 1[Disagree strongly] to 5[Agree strongly]: 'I rarely hold a grudge, even against people who have badly wronged me.", "People sometimes tell me that I am too critical of others.(reverse code)", "People sometimes tell me that I'm too stubborn.(reverse code)", "People think of me as someone who has a quick temper.(reverse code)", "My attitude toward people who have treated me badly is âforgive and forgetâ.", "I tend to be lenient in judging other people.", "I am usually quite flexible in my opinions when people disagree with me.", "Most people tend to get angry more quickly than I do.", "Even when people make a lot of mistakes, I rarely say anything negative.", "When people tell me that I'm wrong, my first reaction is to argue with them.(reverse code)".	
Extraversion		[-1, 1]
Big Five	On a scale from 1[Disagree strongly] to 7[Agree strongly]: "I see myself as someone who is reserved.(reverse code)", "I see myself as someone who is outgoing, sociable.".	
HEXACO	On a scale from 1[Disagree strongly] to 5[Agree strongly]: "I feel reasonably satisfied with myself overall.", "I rarely express my opinions in group meetings.(reverse code)", "I prefer jobs that involve active social interaction to those that involve working alone.", "On most days, I feel cheerful and optimistic.", "I feel that I am an unpopular person.(reverse code)", "In social situations, I'm usually the one who makes the first move.", "The first thing that I always do in a new place is to make friends.", "Most people are more upbeat and dynamic than I generally am.(reverse code)", "I sometimes feel that I am a worthless person.(reverse code)", "When I'm in a group of people, I'm often the one who speaks on behalf of the group.(reverse code)".	
Neuroticism/emotionality		[-1, 1]
Big Five	On a scale from 1[Disagree strongly] to 7[Agree strongly]: "I see myself as someone who is relaxed, handles stress well.(reverse code)", "I see myself as someone who gets nervous easily.".	
HEXACO	On a scale from 1[Disagree strongly] to 5[Agree strongly]: "I would feel afraid if I had to travel in bad weather conditions.", "I sometimes can't help worrying about little things.", "When I suffer from a painful experience, I need someone to make me feel comfortable.", "I feel like crying when I see other people crying.", "When it comes to physical danger, I am very fearful.", "I worry a lot less than most people do.(reverse code)", "I can handle difficult situations without needing emotional support from anyone else.(reverse code)", "I feel strong emotions when someone close to me is going away for a long time.", "Even in an emergency I wouldn't feel like panicking.(reverse code)", "I remain unemotional even in situations where most people get very sentimental.(reverse code).	

Occupationally related items

Expected income	Calculation based on a subject's self-assessed likelihood (p) of having a monthly net income given a full-time employment five years following the completion of specialty training which falls into the following categories: i) less than EUR 3,000 net per month ii) between EUR 3,000 and EUR 3,999 net per month iii) between EUR 4,000 and EUR 4,999 net per month	[2,500, 7,000]

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Variable	Description	Scale
	iv) between EUR 5,000 and EUR 5,999 net per month v) more than EUR 6,000 Euro per month The expected value of future income per subject was calculated as follows: $EV = p_i$ x 2,500 + p_{ii} x 3,500 + p_{iii} x 4,500 + p_{iv} x 5,500+p_v x 6,500	
Specialty choice	Selection of the first most preferred specialty from the following list: Anesthesia, General medicine, Neurology/Psychiatry, Orthopedics, Radiology/Nuclear medicine, Forensic medicine, Urology, Dentistry and maxillary surgery, Ophthalmology, Surgery, Dermatology, Gynecology, Otorhinolaryngology, Internal medicine, Pediatrics, Laboratory medicine, Other (namely)	

B Illustration of Delta method

We applied the Delta method as follows. Without covariates, estimated parameters are a 3×1 vector:

$$\eta_0 = \begin{pmatrix} \eta_0^a \\ \eta_0^r \\ \eta_0^\mu \end{pmatrix}.$$

They are transformed back to their original scale thanks to the $l = 3 \times 1$ vector of monotonic continuously differentiable functions g:

$$\theta_0 = g(\eta_0)$$

or more explicitly:

$$\theta_0 = \begin{pmatrix} \theta_0^a \\ \theta_0^r \\ \theta_0^\mu \end{pmatrix} = \begin{pmatrix} g^a(\eta_0^a) \\ g^r(\eta_0^r) \\ g^\mu(\eta_0^\mu) \end{pmatrix}.$$

Then, for a given estimated covariance matrix of the model parameters, $\hat{V}(\hat{\eta}_0)$, the covariance matrix of θ_0, can be estimated according to the Delta method by:

$$\hat{V}(\hat{\theta}_0) = G(\hat{\eta}_0)\hat{V}(\hat{\eta}_0)G'(\hat{\eta}_0),$$

where $G(\hat{\eta}_0)$ is the 3×3 matrix of $\frac{\partial g^i(\eta)}{\partial \eta^j}$ (the typical element in row i and column j of $G(\hat{\eta}_0)$ is $\frac{\partial g^i(\eta_0)}{\partial \eta_0^j}$):

$$G(\hat{\eta_0}) = \begin{pmatrix} \frac{\partial g^a(\eta_0)}{\partial \eta_0^a} & 0 & 0 \\ 0 & \frac{\partial g^a(\eta_0)}{\partial \eta_0^r} & 0 \\ 0 & 0 & \frac{\partial g^\mu(\eta_0)}{\partial \eta_0^\mu} \end{pmatrix}.$$

We now illustrate the Delta method with dummy variables, where we take gender as an example. Values are transformed back to their original scale with the $l = 3(K+1) \times 1$ vector of monotonic continuously differentiable functions g. For the constant, the transformation is

$$\theta_0 = g(\eta_0).$$

For the dummy variable, the transformation back to the original scale is:

$$\theta_{female} = g(\eta_0 + \eta_{female}) - g(\eta_0).$$

or more explicitly:

$$\begin{pmatrix} \theta_0^a \\ \theta_{female}^a \\ \theta_0^r \\ \theta_{female}^r \\ \theta_0^\mu \\ \theta_{female}^\mu \end{pmatrix} = \begin{pmatrix} g^a(\eta_0^a) \\ g^a(\eta_0^a + \eta_{female}^a) - g^a(\eta_0^a) \\ g(\eta_0^r) \\ g(\eta_0^r + \eta_{female}^r) - g(\eta_0^r) \\ g(\eta_0^\mu) \\ g(\eta_0^\mu + \eta_{female}^\mu) - g(\eta_0^\mu) \end{pmatrix}.$$

$G(\hat{\eta})$ is now a $3(K+1) \times 3$ matrix of $\frac{\partial g^i(\eta)}{\partial \eta^j}$.

$$\begin{pmatrix} \frac{\partial g^a(\eta_0)}{\partial \eta_0^a} & 0 & 0 & 0 & 0 \\ \frac{\partial g^a(\eta_0+\eta_{female}^a)}{\partial \eta_0^a} - \frac{\partial g^a(\eta_0)}{\partial \eta_0^a} & \frac{\partial g^a(\eta_0+\eta_{female}^a)}{\partial \eta_{female}^a} & 0 & 0 & 0 \\ 0 & 0 & \frac{\partial g^r(\eta_0)}{\partial \eta_0^r} & 0 & 0 \\ 0 & 0 & \frac{\partial g^r(\eta_0+\eta_{female}^r)}{\partial \eta_0^r} - \frac{\partial g^r(\eta_0)}{\partial \eta_0^r} & \frac{\partial g^r(\eta_0+\eta_{female}^r)}{\partial \eta_{female}^r} & 0 \\ 0 & 0 & 0 & 0 & \dots \end{pmatrix}.$$

For variables other than dummy variables, such as the scores from the preference module, we proceeded as follows, taking altruism as an example. Values are transformed back to their original scale thanks to the $l = 3(K+1) \times 1$ vector of monotonic continuously differentiable functions g. For the constant, the transformation is:

$$\theta_0 = g(\eta_0).$$

Furthermore, for altruism, the transformation back to the original scale is:

$$\theta_{altruism} = g(\eta_0 + 0.1 \times \eta_{altruism}) - g(\eta_0)$$

Put more explicitly, one has:

$$\begin{pmatrix} \theta_0^a \\ \theta_{altruism}^a \\ \theta_0^r \\ \theta_{altruism}^r \\ \theta_0^\mu \\ \theta_{altruism}^\mu \end{pmatrix} = \begin{pmatrix} g^a(\eta_0^a) \\ g^a(\eta_0^a + 0.1 \times \eta_{altruism}^a) - g^a(\eta_0^a) \\ g(\eta_0^r) \\ g(\eta_0^r + 0.1 \times \eta_{altruism}^r) - g(\eta_0^r) \\ g(\eta_0^\mu) \\ g(\eta_0^\mu + 0.1 \times \eta_{altruism}^\mu) - g(\eta_0^\mu) \end{pmatrix}.$$

$G(\hat{\eta})$ is now a $3(K+1) \times 3$ matrix of $\frac{\partial g^i(\eta)}{\partial \eta^j}$.

$$\begin{pmatrix} \frac{\partial g^a(\eta_0)}{\partial \eta_0^a} & 0 & 0 & 0 & 0 \\ \frac{\partial g^a(\eta_0 + 0.1 \times \eta^a_{altruism})}{\partial \eta_0^a} - \frac{\partial g^a(\eta_0)}{\partial \eta_0^a} & \frac{\partial g^a(\eta_0 + 0.1 \times \eta^a_{altruism})}{\partial \eta^a_{altruism}} & 0 & 0 & 0 \\ 0 & 0 & \frac{\partial g^r(\eta_0)}{\partial \eta_0^r} & 0 & 0 \\ 0 & 0 & \frac{\partial g^r(\eta_0 + 0.1 \times \eta^r_{altruism})}{\partial \eta_0^r} - \frac{\partial g^r(\eta_0)}{\partial \eta_0^r} & \frac{\partial g^r(\eta_0 + 0.1 \times \eta^r_{altruism})}{\partial \eta^r_{altruism}} & 0 \\ 0 & 0 & 0 & 0 & \dots \end{pmatrix}.$$

C Descriptive analysis of the control group

Analogous to Section 5.1, we now provide descriptive statistics on patient-regarding behavior and individuals' characteristics of our control group of non-medical students (N=145) and compare them to our medical student sample, see Table C.1. In what follows, we use cohorts instead of stages in studies to include non-medical students. The cohorts match study stages in terms of years of study as follows: the first cohort corresponds to freshmen (reference category), the second cohort corresponds to pre-clinical phase (students in their first to second year), the third cohort corresponds to clinical phase (third to fifth year) and fourth cohort corresponds to practical year (sixth year and above).

Overall, non-medical students make, on average, 11.9 patient-regarding choices. This corresponds to significantly lower patient-regarding behavior by about one third fewer patient-regarding choices. The significance of less patient-regarding choices in non-medical than medical students is prevalent for each cohort comparisons (p <0.05, t-test). Recall that the progress stages of non-medical students have been synchronized with the medical studies. Students in the first of weeks of their studies correspond to freshmen ("1ST cohort"). Students in the first to second year correspond to the pre-clinical phase ("2ND cohort"), students in their third to fifth year correspond to the clinical phase ("3RD cohort"), and being in the sixth year or above reflects the practical year ("4TH cohort"). When differentiating between study cohorts for non-medical students, students of the first cohort are the most patient-regarding (15.2 *prcs*), students of the fourth cohort are the least patient-regarding (9.7 *prcs*). While, overall speaking, we find patient-regarding behavior to decrease with study progress, students of the third cohort make slightly more patient-regarding choices than students of second cohort (11.1 compared to 10.6 *prcs*). However, this difference is not statistical significant. Comparing the distributions, the Kolmogorov-Smirnoff-test only rejects the hypothesis of identical distributions for the comparison of *prc* the first and fourth cohort ($p < 0.05$). For an illustration of the distributions of *prcs* by cohorts of our control group, see Figure C.1. Students who made no *prc* (referred to as pure profit-maximizers), amount to 5.0% in the first cohort, 30.4% in the second cohort, 12.5% in the third cohort and 23.1% in fourth cohort. Non-medical students who always made the *prc* make up for 5.0% in the first cohort, 8.7% in the second cohort, 7.1% in the third cohort and 3.9% in fourth cohort. While the overall share of pure patient-regarding altruists is similar in non-medical and medical students (6.8% and 7.8%, respectively), there are percentage-wise more than twice as much pure profit-maximizer among non-medical than medical students (15.2% compared to 6.8%).

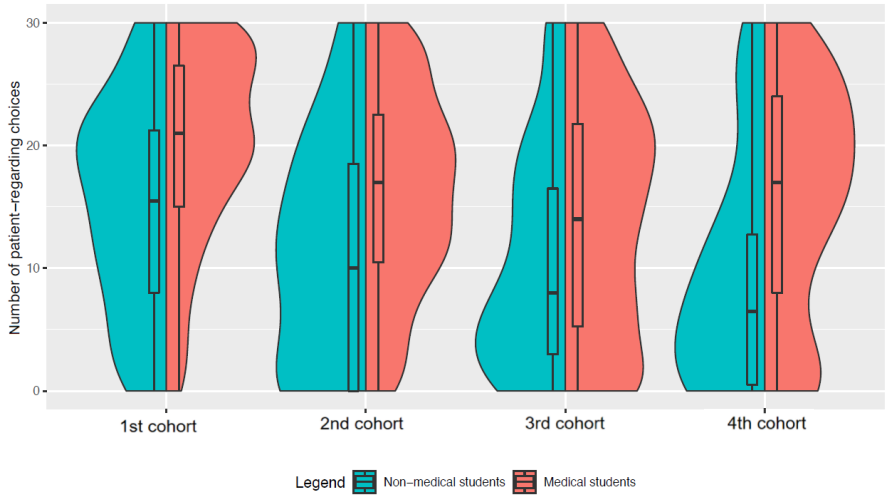
While non-medical students are significantly less patient-regarding than medical students, they do not significantly differ in their general altruistic behavior elicited by the Preference Survey Module by Falk et al. (2016, 2018); see Panel B of Table C.1. They also do not differ in their preferences for negative reciprocity. Whereas, a comparisons of the other social and economic preferences reveals that our non-medical student sample has lower social preferences for trust and positive reciprocity, but higher preferences for time discounting and risk aversion (p <0.05, t-test). In terms of personality traits, non-medical students appear to be less conscientious, less open but more emotional/neurotic than medical students (p <0.10, t-test).

Table C.1: Descriptive statistics of our control group (non-medical students) and our medical student sample

	Non-medical students			Medical students			△, *t*-test
	Mean	s.d.	*N*	Mean	s.d.	*N*	*p*-value
A. Patient-regarding choices							
Total sample	11.9	9.3	145	16.9	9.0	733	<0.001
1ST cohort	15.2	9.0	40	19.8	8.1	259	<0.001
2ND cohort	10.6	9.6	23	16.1	8.3	235	0.001
3RD cohort	11.1	9.1	56	13.8	9.6	158	0.035
4TH cohort	9.7	9.1	26	15.6	9.6	81	0.004
B. Characteristics							
Social and economic preferences							
Altruism	0.37	0.14	144	0.38	0.17	729	0.229
Trust	0.50	0.21	144	0.57	0.24	729	<0.001
Positive reciprocity	0.42	0.16	144	0.36	0.18	729	0.017
Negative reciprocity	0.46	0.15	144	0.47	0.16	729	0.439
Risk aversion	0.09	0.15	145	0.07	0.15	731	<0.050
Time discounting	0.31	0.16	145	0.27	0.16	731	0.003
Personality traits							
Extraversion	0.22	0.27	144	0.25	0.41	729	0.271
Agreeableness	0.10	0.27	144	0.09	0.37	729	0.3071
Conscientiousness	0.29	0.28	144	0.39	0.35	729	<0.001
Openness	0.21	0.31	144	0.27	0.44	729	0.055
Emotionality/Neuroticism	0.17	0.31	144	-0.08	0.43	729	<0.001

Notes. This table presents summary statistics on the number of patient-regarding choices and subject's characteristics for our non-medical students sample and compares it to our medical student sample. Comparisons are based on a one-sided *t*-test with p-values reported in the last column. Subject's characteristics comprise social and economic preferences by the Preference Survey Module (Falk et al., 2016) and personality traits by the 60-item questionnaire of the HEXACO Personality Inventory (Ashton and Lee, 2009). Altruism, trust, positive and negative reciprocity are measured on a scale of [0, 1]. Risk aversion is transformed such that it =0 implies risk neutrality, >0 implies risk aversion and <0 risk seeking. While time discounting = 0 implies patience and a value >0 inpatience. All personality traits are scaled between -1 and 1. Table A.1 in Appendix A.2 gives a full description of all variables.

Figure C.1: Distributions of patient-regarding choices by cohorts for medical and non-medical students



Notes. This figure shows the distributions of the relative frequencies of patient-regarding choices (*prc*) differentiated by study cohorts for medical and non-medical students.

D Further estimations on CES preferences

D.1 Aggregate estimations

Figure D.1 shows the distribution of observed heterogeneity implied by the different set of covariates. Table D.1 shows the results of the aggregate estimations for the CES preference functional with various sets of covariates. Standard errors are clustered at the individual level. Table D.2 shows the corresponding parameter estimates when values are transformed back to the original scale.

Figure D.1: Distributions of parameters a, r and noise for the aggregate model with different sets of covariates, CES preferences

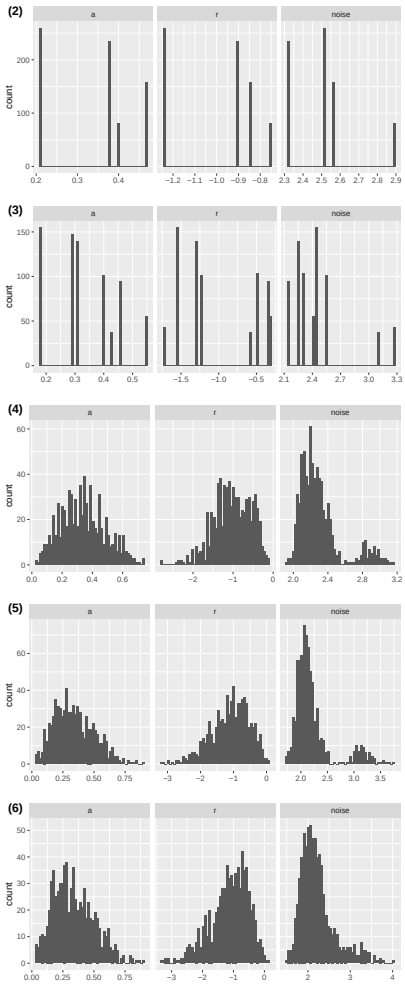


Table D.1: Aggregate estimations, parameter estimates, CES preferences

Model	(1)	(2)	(3)	(4)	(5)	(6)
a						
Constant	-0.669^{***}	-1.330^{***}	-0.879^{***}	0.125^{*}	0.885^{***}	1.039^{***}
	(0.073)	(0.148)	(0.168)	(0.208)	(0.434)	(0.565)
Pre-clinical		0.830^{***}	0.705^{***}	0.653^{***}	0.519^{***}	0.576^{***}
		(0.181)	(0.189)	(0.196)	(0.203)	(0.292)
Clinical		1.197^{***}	1.083^{***}	0.942^{***}	0.701^{***}	0.800^{***}
		(0.190)	(0.196)	(0.199)	(0.205)	(0.275)
Practical Year		0.917^{***}	0.604^{***}	0.694^{***}	0.394^{***}	0.475^{***}
		(0.259)	(0.355)	(0.310)	(0.375)	(0.438)
Female			-0.618^{***}	-0.257^{***}	-0.192^{***}	-0.217^{***}
			(0.124)	(0.125)	(0.120)	(0.193)
General altruism				-3.186^{***}	-2.588^{***}	-2.657^{***}
				(0.420)	(0.470)	(0.498)
Risk aversion					-0.815^{***}	-0.688^{***}
					(0.560)	(0.585)
Time discounting					0.529^{***}	0.414^{***}
					(0.373)	(0.368)
Trust					-0.861^{***}	-0.944^{***}
					(0.277)	(0.318)
Negative reciprocity					0.157	0.103
					(0.501)	(0.781)
Positive reciprocity					-1.211^{***}	-1.243^{***}
					(0.591)	(0.546)
Emotionality						0.065
						(0.225)
Extraversion						0.148^{***}
						(0.229)
Agreeableness						0.176^{***}
						(0.309)
Conscientiousness						-0.313^{***}
						(0.343)
Openness						-0.015
						(0.165)
r						
Constant	-0.671^{***}	-0.807^{***}	-0.401^{***}	-0.303^{***}	-0.395^{***}	-0.310^{***}
	(0.050)	(0.061)	(0.112)	(0.145)	(0.285)	(0.358)
Pre-clinical		0.165^{*}	0.105^{*}	0.103^{**}	0.130^{***}	0.164^{***}
		(0.108)	(0.132)	(0.126)	(0.144)	(0.192)
Clinical		0.193^{*}	0.131	0.208^{***}	0.206^{***}	0.279^{***}
		(0.142)	(0.175)	(0.147)	(0.164)	(0.187)
Practical Year		0.245^{*}	-0.060	0.077	-0.076	-0.010
		(0.208)	(0.303)	(0.268)	(0.343)	(0.379)
Female			-0.539^{***}	-0.309^{***}	-0.285^{***}	-0.271^{***}
			(0.097)	(0.102)	(0.107)	(0.146)
General altruism				-0.718^{***}	-0.770^{***}	-0.744^{***}
				(0.240)	(0.307)	(0.350)
Risk aversion					-0.280^{**}	-0.117
					(0.432)	(0.454)
Time discounting					-0.639^{***}	-0.701^{***}
					(0.407)	(0.416)
Trust					0.397^{***}	0.368^{***}
					(0.223)	(0.262)
Negative reciprocity					0.460^{***}	0.367^{***}
					(0.372)	(0.602)
Positive reciprocity					-0.376^{***}	-0.425^{***}
					(0.436)	(0.405)
Emotionality						-0.041
						(0.161)
Extraversion						0.045
						(0.185)
Agreeableness						0.078
						(0.223)
Conscientiousness						-0.238^{***}
						(0.272)
Openness						0.036
						(0.127)
μ						
Constant	0.964^{***}	0.924^{***}	0.838^{***}	0.810^{***}	0.697^{***}	0.668^{***}
	(0.035)	(0.051)	(0.073)	(0.137)	(0.243)	(0.270)
Pre-clinical		-0.082	-0.077	-0.090^{**}	-0.077^{*}	-0.152^{***}
		(0.081)	(0.099)	(0.101)	(0.106)	(0.144)
Clinical		0.016	0.047	-0.048	-0.038	-0.084^{*}
		(0.104)	(0.128)	(0.130)	(0.133)	(0.146)
Practical Year		0.138	0.293^{***}	0.220^{***}	0.388^{***}	0.332^{***}
		(0.128)	(0.216)	(0.212)	(0.238)	(0.263)
Female			0.053	-0.059	-0.033	-0.003
			(0.083)	(0.091)	(0.090)	(0.111)
General altruism				0.181^{*}	0.130	0.087
				(0.229)	(0.268)	(0.281)
Risk aversion					-0.086	-0.212^{*}
					(0.314)	(0.365)
Time discounting					0.137	0.163
					(0.304)	(0.342)
Trust					-0.056	-0.057
					(0.207)	(0.218)
Negative reciprocity					-0.157	-0.047
					(0.283)	(0.381)
Positive reciprocity					0.267^{**}	0.353^{***}
					(0.324)	(0.340)
Emotionality						-0.037
						(0.110)
Extraversion						-0.179^{***}
						(0.129)
Agreeableness						0.019
						(0.185)
Conscientiousness						0.065
						(0.157)
Openness						-0.023
						(0.106)
N	733	733	733	729	729	729
Log-likelihood	-13,331.09	-13,002.64	-12,884.71	-12,394.66	-12,028.09	-11997.39

Notes. *p<0.10; **p<0.05; ***p<0.01

Table D.2: Aggregate estimations, preference parameters, noise, and marginal effects, CES preferences

Model	(1)	(2)	(3)	(4)	(5)	(6)
a						
Constant	0.339^{***}	0.209^{***}	0.293^{***}	0.531^{*}	0.708^{***}	0.776^{***}
	(0.016)	(0.028)	(0.039)	(0.053)	(0.082)	(0.115)
Pre-clinical		0.168^{***}	0.163^{***}	0.154^{***}	0.095^{***}	0.086^{***}
		(0.038)	(0.045)	(0.048)	(0.044)	(0.056)
Clinical		0.258^{***}	0.257^{***}	0.213^{***}	0.122^{***}	0.109^{***}
		(0.042)	(0.046)	(0.047)	(0.046)	(0.061)
Practical year		0.189^{***}	0.138^{***}	0.163^{***}	0.075^{***}	0.086^{***}
		(0.062)	(0.087)	(0.068)	(0.064)	(0.057)
Female			-0.111^{***}	-0.064^{***}	-0.041^{***}	-0.039^{***}
			(0.025)	(0.031)	(0.027)	(0.042)
General altruism				-0.079^{***}	-0.056^{***}	-0.049^{***}
				(0.011)	(0.013)	(0.022)
Risk aversion					-0.017^{***}	-0.011^{***}
					(0.010)	(0.012)
Time discounting					0.011^{***}	0.006^{***}
					(0.008)	(0.008)
Trust					-0.018^{***}	-0.018^{***}
					(0.006)	(0.007)
Negative reciprocity					0.003	-0.001
					(0.011)	(0.014)
Positive reciprocity					-0.026^{***}	-0.025^{***}
					(0.011)	(0.011)
Emotionality						0.003^{*}
						(0.008)
Extraversion						0.004^{**}
						(0.010)
Agreeableness						0.010^{***}
						(0.010)
Conscientiousness						-0.016^{***}
						(0.011)
Openness						-0.001
						(0.007)
r						
Constant	-0.956^{***}	-1.240^{***}	-0.493^{***}	-0.354^{***}	-0.485^{***}	-0.155
	(0.097)	(0.160)	(0.195)	(0.199)	(0.391)	(0.490)
Pre-clinical		0.342^{*}	0.149	0.132^{**}	0.181^{***}	0.181^{***}
		(0.240)	(0.208)	(0.170)	(0.204)	(0.218)
Clinical		0.393^{*}	0.183	0.254^{***}	0.276^{***}	0.277^{***}
		(0.286)	(0.256)	(0.189)	(0.229)	(0.254)
Practical year		0.486^{*}	-0.092	0.100	-0.118	0.246^{**}
		(0.408)	(0.501)	(0.335)	(0.532)	(0.309)
Female			-1.066^{***}	-0.490^{***}	-0.489^{***}	-0.370^{***}
			(0.210)	(0.188)	(0.235)	(0.272)
General altruism				-0.101^{***}	-0.119^{***}	-0.084^{***}
				(0.030)	(0.061)	(0.078)
Risk aversion					-0.042^{**}	-0.0004
					(0.058)	(0.059)
Time discounting					-0.098^{***}	-0.097^{***}
					(0.063)	(0.078)
Trust					0.058^{***}	0.029^{***}
					(0.039)	(0.037)
Negative reciprocity					0.067^{***}	0.027^{*}
					(0.063)	(0.080)
Positive reciprocity					-0.057^{***}	-0.054^{***}
					(0.061)	(0.054)
Emotionality						-0.003
						(0.038)
Extraversion						0.004
						(0.053)
Agreeableness						0.041^{***}
						(0.051)
Conscientiousness						-0.080^{***}
						(0.060)
Openness						0.010
						(0.034)
μ						
Constant	2.623^{***}	2.519^{***}	2.313^{***}	2.247^{***}	2.007^{***}	1.773^{***}
	(0.092)	(0.130)	(0.181)	(0.308)	(0.504)	(0.480)
Pre-clinical		-0.198	-0.171	-0.194^{**}	-0.149^{*}	-0.266^{***}
		(0.197)	(0.220)	(0.225)	(0.208)	(0.225)
Clinical		0.041	0.112	-0.106	-0.075	-0.137
		(0.266)	(0.306)	(0.287)	(0.264)	(0.259)
Practical year		0.373	0.787^{***}	0.552^{***}	0.951^{***}	0.293^{*}
		(0.362)	(0.657)	(0.571)	(0.683)	(0.569)
Female			0.127	-0.128	-0.064	0.004
			(0.206)	(0.200)	(0.175)	(0.213)
General altruism				0.041^{*}	0.026	0.016
				(0.048)	(0.053)	(0.052)
Risk aversion					-0.017	-0.038^{*}
					(0.061)	(0.063)
Time discounting					0.028	0.042^{**}
					(0.061)	(0.070)
Trust					-0.011	0.004
					(0.043)	(0.038)
Negative reciprocity					-0.031	-0.002
					(0.061)	(0.072)
Positive reciprocity					0.054^{**}	0.074^{***}
					(0.063)	(0.062)
Emotionality						-0.011
						(0.040)
Extraversion						-0.060^{***}
						(0.054)
Agreeableness						-0.020
						(0.073)
Conscientiousness						0.034^{*}
						(0.050)
Openness						-0.018
						(0.039)
N	733	733	733	729	729	705
Log-likelihood	-13,331.09	-13,002.64	-12,884.71	-12,394.66	-12,028.09	-11,537.7

Notes. *p<0.10; **p<0.05; ***p<0.01

D.2 Finite mixture model

As stated in Section 5.3, our econometric model can be extended in several other directions to account for individual heterogeneity. One potential direction to account for heterogeneity identifies distinct preference (and noise) types with a finite mixture model without covariates. We next describe the estimation of distinct preference types using a finite mixture model. Here the population is composed by a finite number of preference types C. Each type $c = 1, \ldots, C$ is present in proportion π_c in the population and is characterized by a (distinct) set of parameters θ_c. Each individual's type is a priori unknown and has a probability π_c to belong to type c. The likelihood associated with a choice sequence T for decision-maker i is now written:

$$P_i(\pi_1, \ldots, \pi_{C-1}, \theta_1, \ldots, \theta_C) = \sum_{c=1}^{C} \pi_c P_i(\theta_c)$$

Taking account theoretical restrictions on parameters (with $\theta_c = g(\zeta_c)$, the likelihood of the sequence of choices for subject i can be written:

$$P_i(\pi_1, \ldots, \pi_{C-1}, \zeta_1, \ldots, \zeta_C) = \sum_{c=1}^{C} \pi_c P_i(g(\zeta_c))$$

And the (grand) log-likelihood to be maximized with respect to the set of proportions and parameters $(\pi_1, \ldots, \pi_{C-1}, \zeta_1, \ldots, \zeta_C)$ is:

$$LL(\pi_1, \ldots, \pi_{C-1}, \zeta_1, \ldots, \zeta_C) = \sum_i ln(P_i(\pi_1, \ldots, \pi_{C-1}, \zeta_1, \ldots, \zeta_C))$$

The log-likelihood is known to be difficult to maximize directly. We follow Bruhin et al. (2019) and first maximize the log-likelihood with an Expectation-Maximisation procedure and then move to a direct maximisation.

Subjects can be classified ex-post in the preference type that best characterize their behavior based on parameters estimates $(\pi_1, \ldots, \pi_{C-1}, \theta_1, \ldots, \theta_C)$. For a given set of proportions and parameters, the probability for subject i associated with a choice sequence T to belong to type c is:

$$\tau_{ic} = \frac{\pi_c P_i(\theta_c)}{\sum_{k=1}^{C} \pi_k P_i(\theta_k)}$$

When evaluated with proportions and parameter estimates at maximum likelihood, τ_{ic} are ex-post probabilities to belong to type c for subject i.

In order to assess the superiority of a finite mixture model over a basic aggregate model with no heterogeneity, we compute several criteria for model selection. First, we compute the well-known Akaike Information criterion (AIC). For a model with C types, the AIC is defined as:

$$AIC(C) = -2LL(\pi_1, \ldots, \pi_{C-1}, \zeta_1, \ldots, \zeta_C) + 2n_m$$

where n_m denotes the number of estimated parameters. The higher the number of parameters to be estimated, the larger the penalty included in the criterion. The preferred model is the one with the minimum AIC value. We also compute the Bayesian information criterion (BIC):

$$BIC(C) = -2LL(\pi_1, \ldots, \pi_{C-1}, \zeta_1, \ldots, \zeta_C) + n_l n(N)$$

Similarly, the preferred model is the one with the minimum BIC value.

The last two criteria are based on entropy $E(C)$:

$$E(C) = -\sum_{c=1}^{C}\sum_{i=1}^{N} \tau_{ic} ln(\tau_{ic})$$

where τ_{ic} are ex-post probabilities to belong to type c for subject i. If each subject is unambiguously classified in a given type, then the entropy is equal to 0. On the opposite, when ex-post probabilities to belong to each type are away from 0 or 1, the entropy is large. The third criteria, the normalized entropy criterion (NEC) is equal to entropy normalized by the difference in log-likelihood between a model with C types and the aggregate model:

$$NEC(C) = \frac{E(C)}{LL(\pi_1, \ldots, \pi_{C-1}, \zeta_1, \ldots, \zeta_C) - LL(\zeta)}$$

The preferred model is the one with the minimum NEC value.

The fourth criteria is the integrated completed likelihood criterion (ICL). This criteria corresponds to the BIC criteria with entropy as included as additional penalty term. Like the NEC, ICL favors C values giving rise to partitioning the data with the greatest evidence. For $C = 1$, the NEC criterion is, by definition, not defined and ICL is equal to BIC.

Estimation results. We estimate a series of finite mixture model in the fashion of Bruhin et al. (2019) to characterize the heterogeneity of preferences in the subject population. We follow Bruhin et al. (2019) and estimate models with $C = 2, 3, 4$ types and then compare these models to the aggregate model without covariates. We use the AIC, BIC, NEC and ICL criteria to assess the best model(s) in terms of fitting.

Table D.3 shows the values of criteria for CES preference functional. According to the NEC criterion a model with two types performs best. According to the other criteria, the model with four types is the best model. The latter suggests that heterogeneity in preference types is substantial. This justifies to investigate heterogeneity more thoughtfully with a random coefficient model. Table D.4 shows the characterization of CES preference types for $C = 2$ and $C = 4$. For $C = 2$, two types emerge: a strongly altruistic type with a low personal share parameter equal to 0.135 and a moderately altruistic type with a high personal share parameter equal to 0.76. For $C = 4$, two additional types appear: extremely altruistic with a share parameter close to zero and Rawlsian type with largely negative r parameter. Both for $C = 2$ and $C = 4$ noise is significantly higher for the most selfish types.

D.3 Random coefficient model

We next detail another econometric specification which incorporates observed and unobserved heterogeneity in a random coefficient model. In a random coefficient model, individual parameters are the sum of two components. The first component ηX_i corresponds to observed heterogeneity. It is similar to the estimated parameters in the aggregate model with covariates. The second component corresponds to unobserved heterogeneity. We denote ψ_i, the 3×1 vector representing this second component. Individual parameters are defined as the sum of observed and unobserved heterogeneity:

$$\theta_i = g(\eta X_i + \psi_i)$$

We assume ψ_i follows a multivariate normal distribution independent of the regressors with covariance matrix Ω. For the sake of readability, we abuse notation and denote the components of Ω:

$$\Omega = \begin{pmatrix} \Omega_{[a,a]} & \Omega_{[a,r]} & \Omega_{[a,\mu]} \\ \Omega_{[a,r]} & \Omega_{[r,r]} & \Omega_{[r,\mu]} \\ \Omega_{[a,\mu]} & \Omega_{[r,\mu]} & \Omega_{[\mu,\mu]} \end{pmatrix}$$

For each subject i, $P_i(\theta_i) = P_i(g(\eta X_i + \psi_i))$ is the choice probability conditional on η and ψ_i. Integrating over ψ gives the unconditional probability for subject i (for given η):

$$P_i(\eta, \Omega) = \int_{\mathbb{R}^3} P_i(g(\eta X_i + \psi)) f(\psi|\Omega) d\psi$$

.

The (grand) log-likelihood is to be maximized with respect to η and Ω is:

$$LL(\eta, \Omega) = \sum_i ln(P_i(\eta, \Omega))$$

.

We use Bayesian hierarchical models to estimate this log-likelihood. Corresponding methods are described at length in Train (2009).

Estimation results. Table D.5 shows the results from the random coefficient model for the CES preference functional with various sets of covariates. The components of the Ω matrix are given in a separate Table D.6. Table D.5 shows the results for parameter estimates.

Table D.7 shows the estimation results with transformation of the estimated parameters. The share parameter a increases with term, with a maximum attained for clinical studies. This effect remains stable after controlling for gender, altruism, preferences and personality measures. Women and altruist-oriented subjects have lower personal share parameter values. Trust, positive reciprocity and conscientiousness also decrease the estimated value of the personal share parameter. Compare to the aggregate estimations, risk aversion is no longer significant in the random coefficient model. The same

applies to agreeableness and extraversion. Still, discounting increases the value of a.

Parameter r also tend to increase with term, but with no firm results among the different estimated models. Estimations show this parameter decrease with gender (being a woman leading to lower values of r and hence higher elasticity of substitution), altruism, discounting and risk aversion. The impact of positive reciprocity and negative reciprocity are no longer significant. On the other hand, trust leads to higher values of r. Noise tends to be lower for pre-clinical students and larger for students in practical years. Discounting is found to increase noise.

Figure D.2 shows the typical indifference curves for the different terms based on preference parameters from model (2). Figure D.3 shows the distribution of observed heterogeneity implied by the different set of covariates and Figure D.4 shows the corresponding distribution of unobserved heterogeneity.

Table D.3: Model selection criteria for finite mixture model, CES preferences

C	AIC	BIC	NEC	ICL
1	26668.18	26681.97	NA	26681.97
2	20147.57	20179.75	0.007	20202.78
3	17922.62	17973.19	0.010	18018.37
4	16950.22	17019.18	0.015	17090.13

Table D.4: Finite mixture model, parameter estimates and preference parameters, CES preferences

	C=2		C=4			
	strongly altruistic	moderately altruistic	Rawls	extremely altr.	strongly altr.	moderately altr.
π	0.609	0.391	0.295	0.207	0.333	0.164
	(0.019)	(0.019)	(0.019)	(0.016)	(0.020)	(0.014)
a	0.135	0.756	1	0.036	0.238	0.739
	(0.011)	(0.021)	(0.023)	(0.022)	(0.011)	(0.014)
r	-1.522	-1.861	-272.333	-1.648	-1.309	0.145
	(0.102)	(0.238)	(1902.769)	(0.575)	(0.091)	(0.107)
μ	1.662	2.012	2.043	1.062	1.114	1.002
	(0.039)	(0.075)	(0.070)	(0.054)	(0.040)	(0.070)
Log-likelihood	-10,066.786	NA	NA	-8,460.111	NA	NA

Figure D.2: Indifference curves for different terms based on random coefficient model, CES preferences

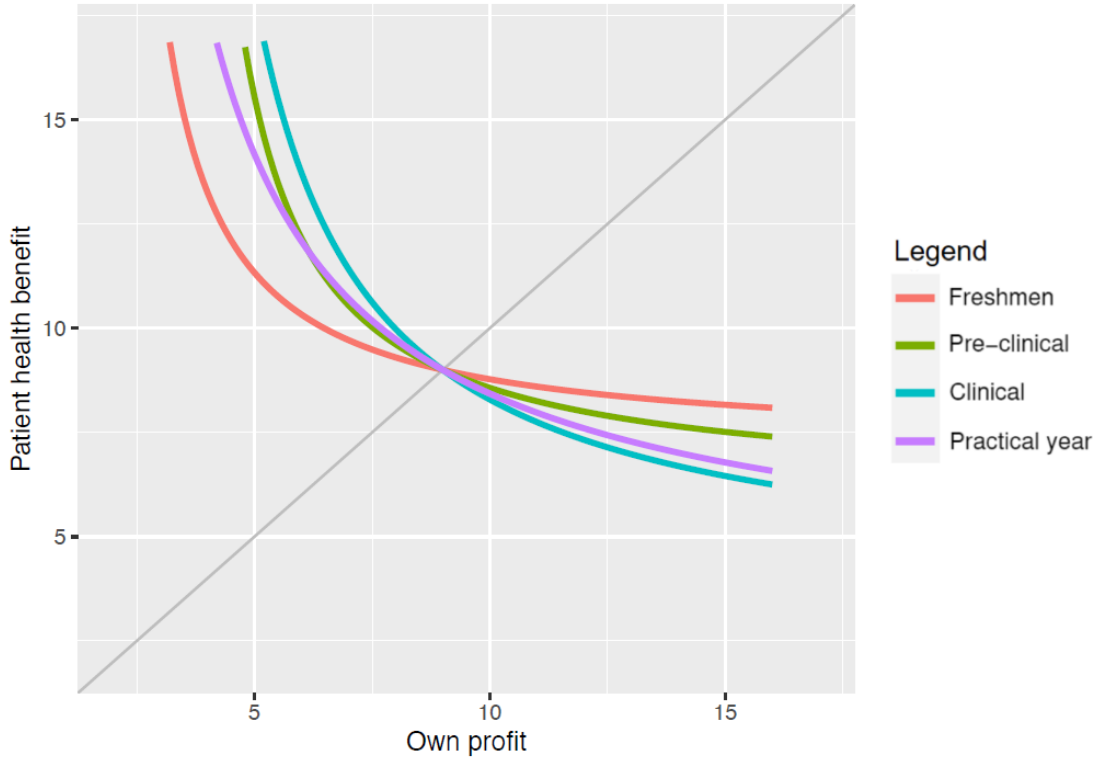


Table D.5: Random coefficient model, parameter estimates, CES preferences

Model	(1)	(2)	(3)	(4)	(5)	(6)
a						
Constant	-0.784^{***}	-1.359^{***}	-0.999^{***}	0.027	0.539^{**}	0.806^{**}
	(0.073)	(0.139)	(0.115)	(0.175)	(0.213)	(0.357)
Pre-clinical		0.678^{***}	0.599^{***}	0.513^{***}	0.434^{***}	0.438^{***}
		(0.187)	(0.156)	(0.142)	(0.098)	(0.146)
Clinical		1.165^{***}	1.127^{***}	0.879^{***}	0.743^{***}	0.695^{***}
		(0.173)	(0.157)	(0.143)	(0.123)	(0.146)
Practical year		0.912^{***}	0.793^{***}	0.684^{***}	0.586^{***}	0.539^{***}
		(0.229)	(0.209)	(0.164)	(0.176)	(0.132)
Female			-0.495^{***}	-0.257^{**}	-0.175^{*}	-0.133
			(0.102)	(0.115)	(0.099)	(0.107)
General altruism				-2.788^{***}	-2.291^{***}	-2.303^{***}
				(0.459)	(0.334)	(0.677)
Risk aversion					-0.457	-0.379
					(0.281)	(0.273)
Time discounting					0.447^{**}	0.262
					(0.184)	(0.162)
Trust					-0.816^{***}	-0.785^{***}
					(0.209)	(0.205)
Negative reciprocity					0.228	-0.115
					(0.195)	(0.220)
Positive reciprocity					-0.882^{**}	-0.838^{***}
					(0.381)	(0.218)
Emotionality						-0.027
						(0.106)
Extraversion						0.001
						(0.096)
Agreeableness						0.065
						(0.154)
Conscientiousness						-0.245^{**}
						(0.119)
Openness						-0.070
						(0.085)
r						
Constant	-0.604^{***}	-0.694^{***}	-0.289^{***}	0.007	-0.008	-0.046
	(0.057)	(0.090)	(0.100)	(0.164)	(0.219)	(0.216)
Pre-clinical		-0.033	-0.068	-0.118	-0.017	-0.014
		(0.131)	(0.131)	(0.125)	(0.094)	(0.128)
Clinical		0.246^{*}	0.252	0.152	0.268^{***}	0.264^{*}
		(0.135)	(0.165)	(0.140)	(0.100)	(0.141)
Practical year		0.385^{**}	0.365^{**}	0.312^{*}	0.383^{***}	0.414^{***}
		(0.176)	(0.186)	(0.163)	(0.137)	(0.149)
Female			-0.624^{***}	-0.508^{***}	-0.488^{***}	-0.466^{***}
			(0.102)	(0.092)	(0.086)	(0.108)
General altruism				-0.844^{***}	-1.093^{***}	-1.019^{***}
				(0.297)	(0.324)	(0.353)
Risk aversion					-0.363^{**}	-0.278
					(0.176)	(0.229)
Time discounting					-1.215^{***}	-1.267^{***}
					(0.269)	(0.228)
Trust					0.466^{***}	0.299
					(0.165)	(0.199)
Negative reciprocity					0.246	0.331
					(0.217)	(0.253)
Positive reciprocity					0.017	0.314^{*}
					(0.141)	(0.187)
Emotionality						-0.146
						(0.114)
Extraversion						-0.170
						(0.117)
Agreeableness						0.165
						(0.139)
Conscientiousness						-0.224
						(0.141)
Openness						0.122
						(0.105)
μ						
Constant	-0.259^{***}	-0.191^{***}	-0.335^{***}	-0.505^{***}	-0.634^{***}	-0.652^{***}
	(0.033)	(0.054)	(0.060)	(0.114)	(0.112)	(0.176)
Pre-clinical		-0.007	0.007	0.026	-0.012	-0.001
		(0.073)	(0.078)	(0.080)	(0.060)	(0.069)
Clinical		-0.239^{***}	-0.244^{***}	-0.208^{**}	-0.266^{***}	-0.229^{***}
		(0.076)	(0.091)	(0.097)	(0.078)	(0.078)
Practical year		-0.098	-0.091	-0.068	-0.085	-0.140
		(0.101)	(0.098)	(0.097)	(0.093)	(0.112)
Female			0.221^{***}	0.184^{***}	0.177^{***}	0.212^{***}
			(0.052)	(0.065)	(0.056)	(0.070)
General altruism				0.453^{**}	0.637^{***}	0.520^{***}
				(0.210)	(0.199)	(0.157)
Risk aversion					0.007	-0.098
					(0.169)	(0.209)
Time discounting					0.829^{***}	0.656^{***}
					(0.177)	(0.154)
Trust					-0.176^{*}	0.030
					(0.105)	(0.108)
Negative reciprocity					-0.088	-0.011
					(0.156)	(0.153)
Positive reciprocity					0.018	-0.038
					(0.136)	(0.146)
Emotion						0.080
						(0.070)
Extraversion						-0.038
						(0.080)
Agreeableness						-0.041
						(0.079)
Conscientiousness						0.008
						(0.093)
Openness						-0.123^{*}
						(0.063)
N	733	733	733	729	729	705
Log-likelihood	-5,562.34	-5,574.82	-5,555.61	-5,518.31	-5,508.63	-5,311.27

Notes. *p<0.10; **p<0.05; ***p<0.01

Table D.6: Random coefficient model, covariance parameter estimates, CES preferences

Model	(1)	(2)	(3)	(4)	(5)	(6)
$\Omega_{[a,a]}$	2.068^{***}	1.902^{***}	1.808^{***}	1.529^{***}	1.426^{***}	1.362^{***}
	(0.205)	(0.187)	(0.173)	(0.156)	(0.134)	(0.128)
$\Omega_{[r,r]}$	1.370^{***}	1.382^{***}	1.251^{***}	1.209^{***}	1.119^{***}	1.149^{***}
	(0.154)	(0.164)	(0.141)	(0.139)	(0.122)	(0.131)
$\Omega_{[\mu,\mu]}$	0.365^{***}	0.359^{***}	0.350^{***}	0.343^{***}	0.324^{***}	0.326^{***}
	(0.040)	(0.041)	(0.041)	(0.043)	(0.039)	(0.039)
$\Omega_{[a,r]}$	0.488^{***}	0.466^{***}	0.360^{***}	0.276^{***}	0.301^{***}	0.267^{***}
	(0.127)	(0.122)	(0.114)	(0.101)	(0.090)	(0.093)
$\Omega_{[a,\mu]}$	-0.225^{***}	-0.192^{***}	-0.151^{**}	-0.119^{**}	-0.125^{**}	-0.135^{***}
	(0.066)	(0.062)	(0.060)	(0.054)	(0.052)	(0.052)
$\Omega_{[r,\mu]}$	-0.532^{***}	-0.526^{***}	-0.470^{***}	-0.460^{***}	-0.413^{***}	-0.421^{***}
	(0.062)	(0.064)	(0.060)	(0.060)	(0.053)	(0.057)
N	733	733	733	729	729	705
Log-likelihood	-5,562.34	-5,574.82	-5,555.61	-5,518.31	-5,508.63	-5,311.27

Notes. *p<0.10; **p<0.05; ***p<0.01

Figure D.3: Distributions of parameters a, r and noise based on observed heterogeneity for the random coefficient model with different sets of covariates, CES preferences

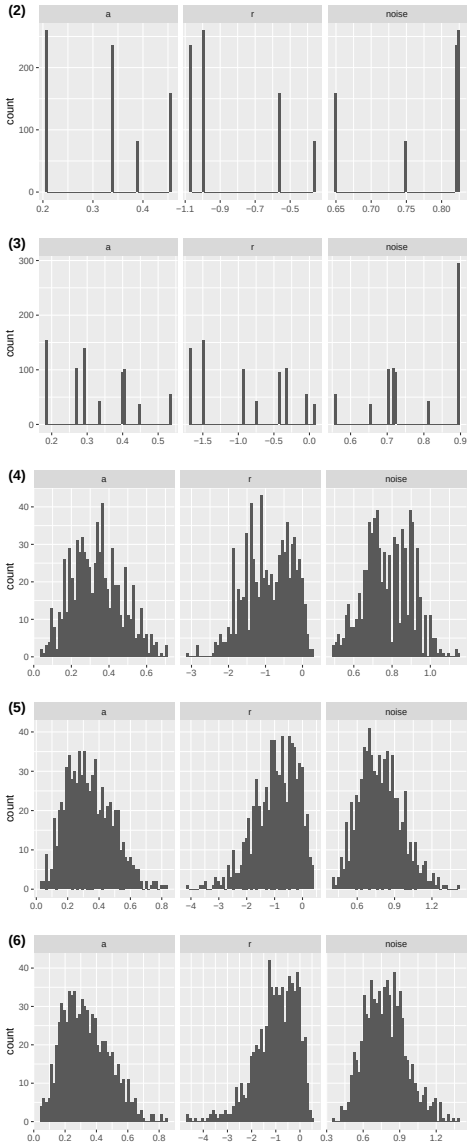
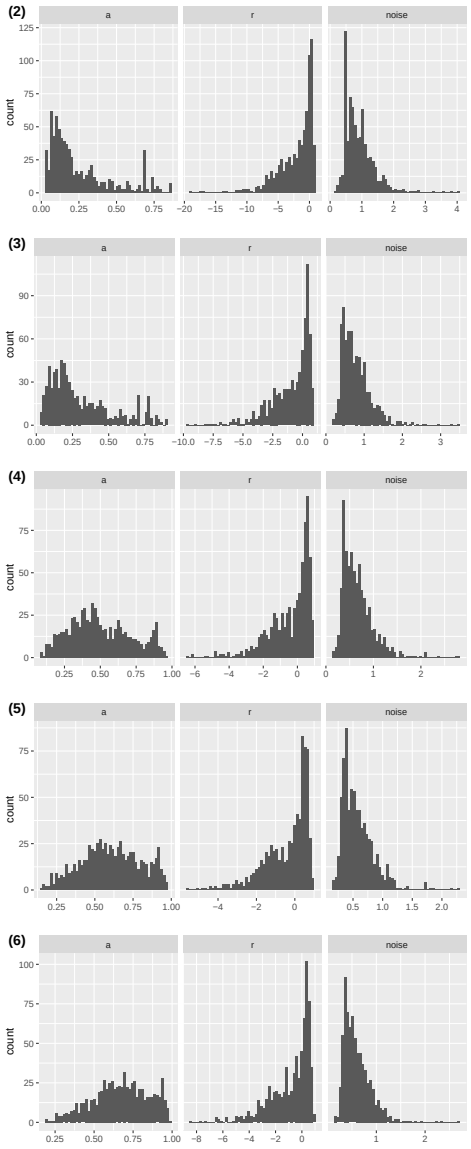


Table D.7: Random coefficient model, preference parameters, noise, and marginal effects, CES preferences

Model	(1)	(2)	(3)	(4)	(5)	(6)
a						
Constant	0.314***	0.205***	0.270***	0.507***	0.630***	0.687***
	(0.016)	(0.022)	(0.023)	(0.043)	(0.050)	(0.081)
Pre-clinical		0.131***	0.132***	0.123***	0.094***	0.084***
		(0.035)	(0.035)	(0.032)	(0.023)	(0.031)
Clinical		0.247***	0.262***	0.203***	0.151***	0.126***
		(0.035)	(0.036)	(0.029)	(0.028)	(0.036)
Pratical year		0.186***	0.179***	0.161***	0.122***	0.100***
		(0.049)	(0.049)	(0.033)	(0.036)	(0.028)
Female			−0.086***	−0.064**	−0.041*	−0.029
			(0.017)	(0.029)	(0.024)	(0.024)
General altruism				−0.069***	−0.054***	−0.049***
				(0.012)	(0.008)	(0.013)
Risk aversion					−0.011	−0.008
					(0.007)	(0.006)
Time discounting					0.010**	0.006
					(0.005)	(0.003)
Trust					−0.019***	−0.017***
					(0.005)	(0.005)
Negative reciprocity					0.005	−0.002
					(0.005)	(0.005)
Positive reciprocity					−0.021**	−0.018***
					(0.009)	(0.004)
Emotionality						−0.001
						(0.004)
Extraversion						0.0001
						(0.004)
Agreeableness						0.003
						(0.007)
Conscientiousness						−0.010**
						(0.005)
Openness						−0.003
						(0.004)
r						
Constant	−0.833***	−1.009***	−0.342***	−0.007	−0.033	−0.072
	(0.105)	(0.182)	(0.132)	(0.168)	(0.237)	(0.233)
Pre-clinical		−0.024	−0.037	−0.024	−0.002	−0.001
		(0.102)	(0.073)	(0.026)	(0.011)	(0.014)
Clinical		0.191*	0.135	0.029	0.031**	0.027
		(0.109)	(0.091)	(0.028)	(0.014)	(0.024)
Practical year		0.295*	0.192**	0.060*	0.043***	0.039
		(0.152)	(0.097)	(0.035)	(0.016)	(0.025)
Female			−0.363***	−0.106***	−0.061***	−0.049
			(0.070)	(0.026)	(0.018)	(0.032)
General altruism				−0.181**	−0.144***	−0.098***
				(0.073)	(0.054)	(0.027)
Risk aversion					−0.046*	−0.028
					(0.026)	(0.022)
Time discounting					−0.162***	−0.135***
					(0.046)	(0.051)
Trust					0.052***	0.024
					(0.019)	(0.021)
Negative reciprocity					0.029	0.030
					(0.026)	(0.026)
Positive reciprocity					0.002	0.032
					(0.017)	(0.027)
Emotion						−0.013
						(0.011)
Extraversion						−0.016
						(0.012)
Agreeableness						0.016
						(0.016)
Conscientiousness						−0.023
						(0.017)
Openness						0.011
						(0.011)
μ						
Constant	0.772***	0.827***	0.717***	0.607***	0.534***	0.529***
	(0.025)	(0.044)	(0.043)	(0.068)	(0.061)	(0.098)
Pre-clinical		−0.0002	0.001	0.005	−0.004	0.001
		(0.004)	(0.006)	(0.017)	(0.022)	(0.036)
Clinical		−0.012***	−0.017***	−0.043*	−0.091***	−0.102**
		(0.004)	(0.006)	(0.022)	(0.034)	(0.041)
Practical year		−0.005	−0.006	−0.014	−0.030	−0.060
		(0.005)	(0.007)	(0.021)	(0.034)	(0.054)
Female			0.017***	0.039**	0.063***	0.102**
			(0.005)	(0.016)	(0.023)	(0.047)
General altruism				0.100*	0.248**	0.273**
				(0.052)	(0.099)	(0.135)
Risk aversion					0.003	−0.037
					(0.064)	(0.091)
Time discounting					0.321***	0.346**
					(0.104)	(0.147)
Trust					−0.062	0.018
					(0.038)	(0.052)
Negative reciprocity					−0.028	−0.006
					(0.051)	(0.073)
Positive reciprocity					0.004	−0.008
					(0.044)	(0.058)
Emotion						0.039
						(0.036)
Extraversion						−0.017
						(0.039)
Agreeableness						−0.019
						(0.038)
Conscientiousness						0.002
						(0.048)
Openness						−0.058
						(0.036)
N	733	733	733	729	729	705
Log-likelihood	-5,562.34	-5,574.82	-5,555.61	-5,518.31	-5,508.63	-5,311.27

Notes. *p<0.10; **p<0.05; ***p<0.01

Figure D.4: Distributions of parameters a, r and noise based on unobserved heterogeneity for the random coefficient model with different sets of covariates, CES preferences



D.4 Individual estimates

A last alternative to account for individual heterogeneity is to estimate the preference and noise parameters for each individual separately. For individual estimations, the individual log-likelihood $ln(P_i(\theta_i, \mu_i)$ is maximized with respect to θ_i and μ_i for each subject i. Because individual estimations might depends on initial values of parameters (Bruhin et al., 2019), for each individual estimation we run a series of 3^3 estimations with different starting values. The set of starting values is constructed as a grid of all combinations of $a = \{0.1, 0.5, 0.9\}$, $r = \{-10, -2, 0.5\}$ and $\mu = \{0.5, 2, 5\}$ for the CES preferences. The individual estimates corresponding the best fitting parameter estimates out of the 3^3 possible values. When convergence is not attained, all parameter estimates at the subject level are treated as missing.

Estimation results. Table D.8 shows the results of the individual estimations for the CES preferences. Table D.8 reports the descriptive statistics for the parameter estimates (Column 1) and the preference estimates transformed back to their original scale (Column 2).

Table D.8: Individual results: descriptive statistics, median and interquartile range, CES preferences

	Parameter estimates	Preference parameters
a	-0.61	0.352
Q1-Q3	-1.473 - 0.045	0.186 - 0.511
r	-0.809	-1.245
Q1-Q3	-1.656 - 0.044	-4.239 - 0.043
μ	-0.462	0.63
Q1-Q3	-1.443 - 0.06	0.236 - 1.062
Log-likelihood	-7.763	
Q1-Q3	-11.448 - -4.225	
N	610	

D.5 Estimation results for all subjects

We next report the estimation results for all subjects including our control group of non-medical students for direction of our econometric model. First, we account for observed heterogeneity in the aggregate estimation. Second, we account for both observed and unobserved heterogeneity in a random coefficient model.

Estimation results of aggregate estimation. Table D.9 shows the result of the aggregate estimations for the CES preference functional with various sets of covariates with standard errors clustered at the individual subject level. Figure D.5 shows the typical indifference curves for medical and non-medical students based on parameter estimates from Model (2).

Table D.9: Aggregate estimations, parameter estimates for medical and non-medical students, CES preferences

Model	(1)	(2)	(3)	(4)	(5)
a					
Constant	-0.536^{***}	-1.397^{***}	-0.774^{***}	0.086	0.779^{***}
	(0.066)	(0.154)	(0.148)	(0.188)	(0.347)
2ND cohort		0.895^{***}	0.582^{***}	0.682^{***}	0.576^{***}
		(0.191)	(0.179)	(0.176)	(0.175)
3RD cohort		1.232^{***}	0.961^{***}	0.932^{***}	0.726^{***}
		(0.199)	(0.181)	(0.178)	(0.181)
4TH cohort		1.079^{***}	0.659^{***}	0.792^{***}	0.576^{***}
		(0.209)	(0.256)	(0.234)	(0.303)
Female			-0.733^{***}	-0.330^{***}	-0.264^{***}
			(0.161)	(0.120)	(0.123)
General altruism				-2.989^{***}	-2.455^{***}
				(0.421)	(0.461)
Risk aversion					-0.957^{***}
					(0.461)
Time discounting					0.551^{***}
					(0.360)
Trust					-0.809^{***}
					(0.249)
Negative reciprocity					0.025
					(0.463)
Positive reciprocity					-0.959^{***}
					(0.479)
Non-medical students		0.894^{***}	0.923^{***}	0.844^{***}	0.778^{***}
		(0.227)	(0.178)	(0.193)	(0.186)
r					
Constant	-0.670^{***}	-0.844^{***}	-0.318^{***}	-0.330^{***}	-0.393^{***}
	(0.051)	(0.066)	(0.132)	(0.138)	(0.250)
2ND cohort		0.201^{***}	-0.010	0.131^{***}	0.181^{***}
		(0.133)	(0.146)	(0.118)	(0.127)
3RD cohort		0.121	-0.111	0.136^{**}	0.187^{***}
		(0.224)	(0.283)	(0.143)	(0.145)
4TH cohort		0.433^{***}	0.007	0.194^{***}	0.051
		(0.180)	(0.239)	(0.199)	(0.303)
Female			-0.620^{***}	-0.358^{***}	-0.346^{***}
			(0.141)	(0.104)	(0.117)
General altruism				-0.575^{***}	-0.676^{***}
				(0.259)	(0.321)
Risk aversion					-0.371^{***}
					(0.396)
Time discounting					-0.659^{***}
					(0.402)
Trust					0.457^{***}
					(0.211)
Negative reciprocity					0.251^{**}
					(0.375)
Positive reciprocity					-0.241^{**}
					(0.391)
Non-medical students		-0.203^{**}	0.046	-0.100	-0.047
		(0.289)	(0.237)	(0.263)	(0.256)
μ					
Constant	1.008^{***}	0.938^{***}	0.788^{***}	0.777^{***}	0.597^{***}
	(0.034)	(0.055)	(0.098)	(0.125)	(0.233)
2ND cohort		-0.079	0.042	-0.099^{**}	-0.098^{**}
		(0.103)	(0.111)	(0.093)	(0.100)
3RD cohort		0.068	0.211^{***}	0.016	-0.007
		(0.149)	(0.162)	(0.119)	(0.118)
4TH cohort		0.0003	0.245^{***}	0.133^{**}	0.310^{***}
		(0.158)	(0.194)	(0.183)	(0.220)
Female			0.070^{*}	-0.055	-0.014
			(0.109)	(0.090)	(0.088)
General altruism				0.250^{**}	0.237^{**}
				(0.219)	(0.253)
Risk aversion					-0.024
					(0.303)
Time discounting					0.215^{**}
					(0.282)
Trust					-0.055
					(0.189)
Negative reciprocity					-0.063
					(0.290)
Positive reciprocity					0.223^{**}
					(0.292)
Non-medical students		0.179^{***}	0.061	0.204^{***}	0.248^{***}
		(0.157)	(0.162)	(0.154)	(0.153)
N	878	878	878	873	873
Log-likelihood	-16,279.32	-15,661.38	-15,486.70	-14,981.08	-14,620.35

Notes. *p<0.10; **p<0.05; ***p<0.01

Figure D.5: Indifference curves for medical and non medical students for aggregate estimation, CES preferences

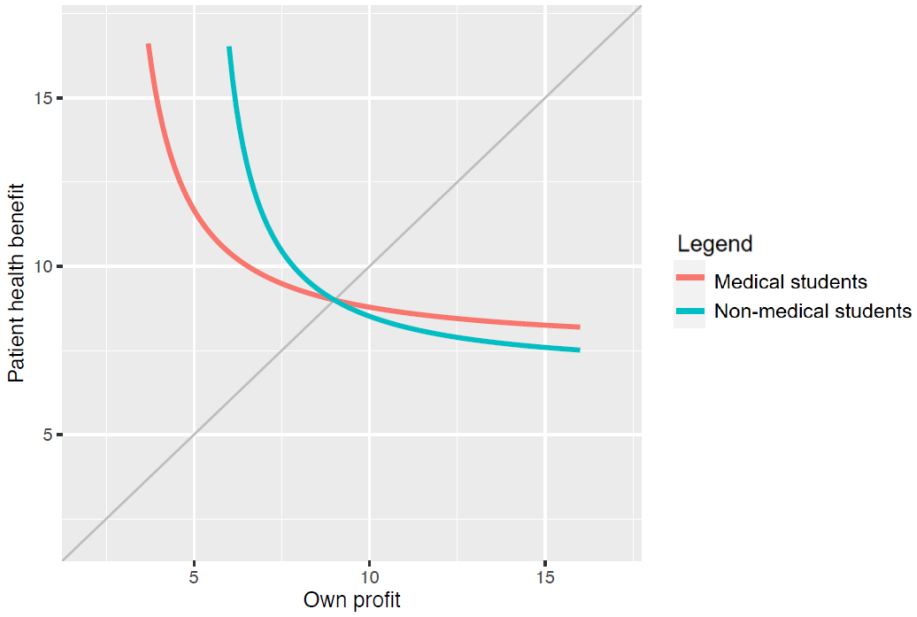


Table D.10 shows the estimation results when estimated parameters are transformed back to the original scale. The personal share parameter a increases with term, with a maximum attained for the second term category. This effect remains stable after controling for gender, altruism, preferences and personnality measures. Women and altruist-oriented subjects have lower personal share parameter values while non medical student have high higher share parameter a (for oneself). Risk aversion, trust, positive reciprocity decrease the estimated value of the personal share parameter. On the other hand, discounting increases the value of a.

Parameter r also tend to increase with term, but with no firm results among the different regression. Estimations shows this parameter decreases with gender (being a woman leading to lower values of r), altruism, discounting, positive reciprocity and risk aversion. No stable effect is associated with non-medical students. On the other hand, trust and negative reciprocity lead to higher values of r, i.e. to lower values of the elasticity of substitution. Noise tends to be larger for the fourth cohort. Positive reciprocity, altruism and discounting are found to increase noise. Non-medical students also display a higher level of noise. Figure D.6 shows the distribution of observed heterogeneity implied by the different set of covariates.

Estimation results of random coefficient model. Table D.11 shows the result from the random coefficient model for the CES preference functional with various sets of covariates. The components of the Ω matrix are given in table D.12. Table D.13 shows the estimation results when estimated parameters are transformed back to the original scale. The personal share parameter a increases with term, with a maximum attained for the third cohort. This effect remains stable after controlling for gender, altruism and preferences. Women and altruist-oriented subjects have lower personal share parameter values. Trust, risk aversion and positive reciprocity also decrease the estimated value of the personal share parameter. Compared to the aggregate estimation risk aversion is significant and discounting is no longer significant. Non-medical students have higher value of the personal share parameter.

Parameter r also tend to increase with term for the third and fourth cohort. Estimations show this parameter decreases with gender (being a woman leading to lower values of r), altruism, discounting and risk aversion. The impact of positive reciprocity and negative reciprocity are no longer significant. On the other hand, trust lead to higher values of r. No systematic impact is associated with non-medical students on r. Noise tends to be lower for the third cohort. Discounting and gender (being a women) are found to increase noise. No systematic impact is associated with non-medical students on noise parameter.

Figure D.7 shows the typical indifference curves for medical and non-medical students based on parameter estimates for Model (2).

Figure D.6: Distributions of parameters a, r and noise for the aggregate model with different sets of covariates for medical and non medical students, CES preferences

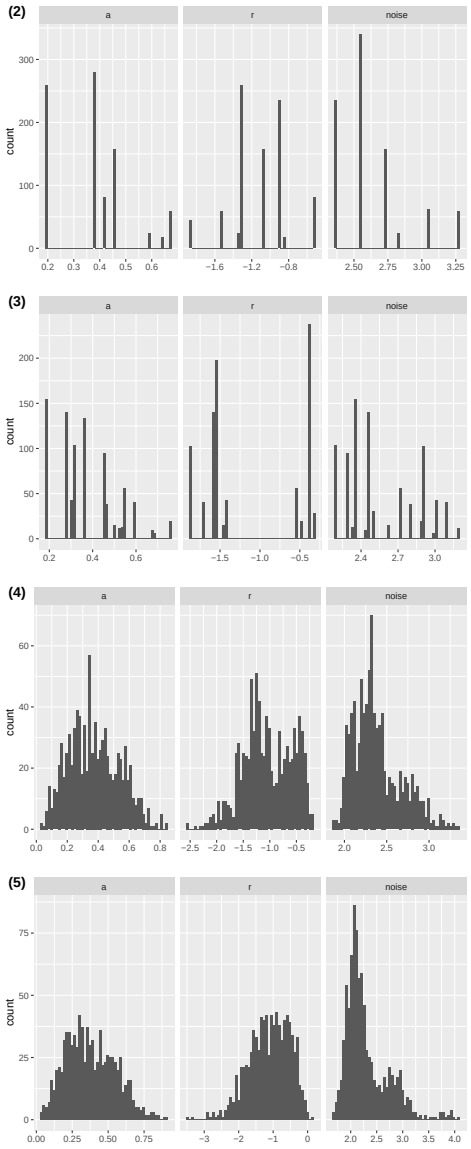


Table D.10: Aggregate estimations, preference parameters, noise, and marginal effects for medical and non-medical students, CES preferences

Model	(1)	(2)	(3)	(4)	(5)
a					
Constant	0.369***	0.198***	0.316***	0.522	0.685***
	(0.015)	(0.025)	(0.032)	(0.047)	(0.075)
2ND cohort		0.179***	0.137***	0.162***	0.110***
		(0.036)	(0.041)	(0.043)	(0.041)
3RD cohort		0.261***	0.231***	0.213***	0.133***
		(0.040)	(0.042)	(0.042)	(0.043)
4TH cohort		0.223***	0.156***	0.185***	0.109***
		(0.043)	(0.061)	(0.053)	(0.056)
Female			−0.134***	−0.082***	−0.059***
			(0.030)	(0.029)	(0.029)
General altruism				−0.075***	−0.055***
				(0.011)	(0.011)
Risk aversion					−0.021***
					(0.010)
Time discounting					0.012***
					(0.008)
Trust					−0.018***
					(0.005)
Negative reciprocity					0.001
					(0.010)
Positive reciprocity					−0.021***
					(0.010)
Non-medical students		0.179***	0.222***	0.196***	0.140***
		(0.051)	(0.043)	(0.041)	(0.039)
r					
Constant	−0.955***	−1.326***	−0.374***	−0.391***	−0.482***
	(0.100)	(0.154)	(0.181)	(0.192)	(0.370)
2ND cohort		0.424***	−0.013	0.171***	0.245***
		(0.270)	(0.202)	(0.160)	(0.191)
3RD cohort		0.266	−0.161	0.177**	0.253***
		(0.461)	(0.427)	(0.188)	(0.207)
4TH cohort		0.817***	0.009	0.245***	0.074
		(0.297)	(0.327)	(0.243)	(0.429)
Female			−1.179***	−0.599***	−0.612***
			(0.253)	(0.201)	(0.275)
General altruism				−0.082***	−0.104***
				(0.033)	(0.056)
Risk aversion					−0.056***
					(0.061)
Time discounting					−0.101***
					(0.059)
Trust					0.066***
					(0.039)
Negative reciprocity					0.037**
					(0.058)
Positive reciprocity					−0.036**
					(0.057)
Non-medical students		−0.524**	0.062	−0.146	−0.071
		(0.817)	(0.312)	(0.401)	(0.394)
μ					
Constant	2.739***	2.554***	2.199***	2.175***	1.816***
	(0.094)	(0.140)	(0.215)	(0.271)	(0.424)
2ND cohort		−0.195	0.094	−0.205**	−0.170**
		(0.249)	(0.249)	(0.199)	(0.183)
3RD cohort		0.180	0.516***	0.035	−0.013
		(0.406)	(0.430)	(0.261)	(0.214)
4TH cohort		0.001	0.611***	0.308**	0.661***
		(0.403)	(0.517)	(0.441)	(0.531)
Female			0.159*	−0.117	−0.026
			(0.244)	(0.191)	(0.159)
General altruism				0.055**	0.043**
				(0.044)	(0.047)
Risk aversion					−0.004
					(0.055)
Time discounting					0.039**
					(0.050)
Trust					−0.010
					(0.035)
Negative reciprocity					−0.011
					(0.054)
Positive reciprocity					0.041**
					(0.052)
Non-medical students		0.501***	0.138	0.491***	0.511***
		(0.470)	(0.376)	(0.405)	(0.377)
N	878	878	878	873	873
Log-likelihood	-16,279.32	-15,661.38	-15,486.70	-14,981.08	-14,620.35

Notes. *p<0.10; **p<0.05; ***p<0.01

Table D.11: Random coefficient model, parameter estimates for medical and non medical students, CES preferences

Model	(1)	(2)	(3)	(4)	(5)
a					
Constant	-0.673^{***}	-1.317^{***}	-1.017^{***}	0.036	0.424
	(0.068)	(0.091)	(0.162)	(0.138)	(0.374)
2ND cohort		0.623^{***}	0.665^{***}	0.572^{***}	0.456^{***}
		(0.123)	(0.174)	(0.135)	(0.119)
3RD cohort		1.012^{***}	1.112^{***}	0.908^{***}	0.757^{***}
		(0.111)	(0.198)	(0.115)	(0.097)
4TH cohort		0.891^{***}	0.925^{***}	0.742^{***}	0.614^{***}
		(0.171)	(0.251)	(0.178)	(0.149)
Female			-0.552^{***}	-0.314^{***}	-0.310^{***}
			(0.109)	(0.115)	(0.093)
General altruism				-2.894^{***}	-2.411^{***}
				(0.431)	(0.323)
Risk aversion					-0.517^{***}
					(0.157)
Time discounting					0.456
					(0.309)
Trust					-0.672^{***}
					(0.167)
Negative reciprocity					0.115
					(0.396)
Positive reciprocity					-0.486^{**}
					(0.240)
Non-medical students		0.714^{***}	0.711^{***}	0.748^{***}	0.636^{***}
		(0.133)	(0.142)	(0.153)	(0.117)
r					
Constant	-0.587^{***}	-0.732^{***}	-0.278^{***}	-0.020	-0.310
	(0.053)	(0.085)	(0.102)	(0.150)	(0.329)
2ND cohort		0.019	-0.023	-0.062	0.036
		(0.125)	(0.107)	(0.119)	(0.114)
3RD cohort		0.281^{**}	0.283^{**}	0.243^{*}	0.339^{***}
		(0.116)	(0.129)	(0.141)	(0.131)
4TH cohort		0.410^{**}	0.450^{***}	0.341^{**}	0.496^{***}
		(0.187)	(0.147)	(0.171)	(0.136)
Female			-0.713^{***}	-0.544^{***}	-0.547^{***}
			(0.094)	(0.088)	(0.101)
General altruism				-0.897^{***}	-0.945^{***}
				(0.312)	(0.297)
Risk aversion					-0.660^{**}
					(0.310)
Time discounting					-1.127^{***}
					(0.257)
Trust					0.524^{**}
					(0.265)
Negative reciprocity					0.381
					(0.290)
Positive reciprocity					0.265
					(0.161)
Non-medical students		0.178	0.175	0.247^{*}	0.321^{*}
		(0.122)	(0.137)	(0.149)	(0.166)
μ					
Constant	-0.262^{***}	-0.177^{***}	-0.331^{***}	-0.513^{***}	-0.483^{***}
	(0.030)	(0.047)	(0.062)	(0.079)	(0.173)
2ND cohort		-0.020	-0.003	0.020	-0.022
		(0.066)	(0.071)	(0.064)	(0.064)
3RD cohort		-0.256^{***}	-0.256^{***}	-0.238^{***}	-0.302^{***}
		(0.066)	(0.075)	(0.076)	(0.077)
4TH cohort		-0.116	-0.137	-0.066	-0.162^{*}
		(0.104)	(0.103)	(0.096)	(0.084)
Female			0.248^{***}	0.184^{***}	0.183^{***}
			(0.056)	(0.055)	(0.052)
General altruism				0.529^{***}	0.585^{***}
				(0.173)	(0.199)
Risk aversion					0.061
					(0.178)
Time discounting					0.771^{***}
					(0.141)
Trust					-0.226^{*}
					(0.121)
Negative reciprocity					-0.164
					(0.173)
Positive reciprocity					-0.047
					(0.181)
Non-medical students		-0.007	-0.006	-0.010	-0.045
		(0.075)	(0.075)	(0.080)	(0.082)
N	878	878	878	873	873
Log-likelihood	-6,615.2	-6,631.76	-6,624.59	-6,582.66	-6,578.67

Notes. *p<0.10; **p<0.05; ***p<0.01

Table D.12: Random coefficient model, covariance parameter estimates for medical and non medical students, CES preferences

Model	(1)	(2)	(3)	(4)	(5)
$\Omega_{[a,a]}$	2.326***	2.045***	1.977***	1.727***	1.624***
	(0.211)	(0.180)	(0.179)	(0.152)	(0.145)
$\Omega_{[r,r]}$	1.471***	1.445***	1.332***	1.303***	1.245***
	(0.145)	(0.148)	(0.147)	(0.138)	(0.128)
$\Omega_{[\mu,\mu]}$	0.368***	0.358***	0.344***	0.337***	0.316***
	(0.038)	(0.038)	(0.037)	(0.035)	(0.036)
$\Omega_{[a,r]}$	0.548***	0.481***	0.373***	0.300***	0.332***
	(0.127)	(0.112)	(0.110)	(0.095)	(0.097)
$\Omega_{[a,\mu]}$	−0.228***	−0.187***	−0.143***	−0.111**	−0.127***
	(0.061)	(0.060)	(0.055)	(0.050)	(0.047)
$\Omega_{[r,\mu]}$	−0.544***	−0.528***	−0.474***	−0.466***	−0.432***
	(0.059)	(0.058)	(0.055)	(0.055)	(0.054)
N	878	878	878	873	873
Log-likelihood	-6,615.2	-6,631.76	-6,624.59	-6,582.66	-6,578.67
Notes.					*p<0.10; **p<0.05; ***p<0.01

Figure D.7: Indifference curves for medical and non medical students based on random coefficient model, CES preferences

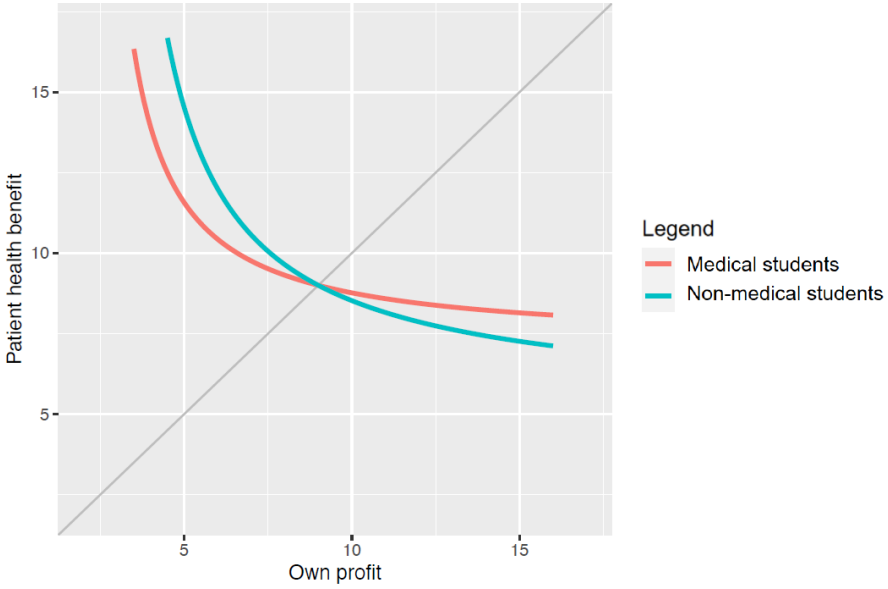


Table D.13: Random coefficient model, preference parameters, noise, and marginal effects for medical and non medical students, CES preferences

Model	(1)	(2)	(3)	(4)	(5)
a					
Constant	0.338***	0.212***	0.267***	0.509***	0.601***
	(0.015)	(0.015)	(0.032)	(0.034)	(0.086)
2ND cohort		0.122***	0.146***	0.137***	0.099***
		(0.025)	(0.037)	(0.031)	(0.024)
3RD cohort		0.213***	0.257***	0.210***	0.157***
		(0.025)	(0.043)	(0.027)	(0.027)
4TH cohort		0.184***	0.210***	0.174***	0.129***
		(0.038)	(0.057)	(0.038)	(0.031)
Female			−0.093***	−0.077***	−0.074***
			(0.022)	(0.028)	(0.024)
General altruism				−0.072***	−0.057***
				(0.011)	(0.008)
Risk aversion					−0.012***
					(0.004)
Time discounting					0.011
					(0.008)
Trust					−0.016***
					(0.003)
Negative reciprocity					0.003
					(0.009)
Positive reciprocity					−0.011**
					(0.005)
Non-medical students		0.143***	0.158***	0.176***	0.134***
		(0.030)	(0.033)	(0.032)	(0.027)
r					
Constant	−0.802***	−1.087***	−0.328**	−0.032	−0.439
	(0.095)	(0.177)	(0.135)	(0.152)	(0.477)
2ND cohort		0.015	−0.011	−0.011	0.006
		(0.092)	(0.061)	(0.023)	(0.017)
3RD cohort		0.206**	0.154**	0.047	0.047*
		(0.087)	(0.075)	(0.028)	(0.025)
4TH cohort		0.297**	0.242***	0.064*	0.065**
		(0.140)	(0.088)	(0.033)	(0.027)
Female			−0.428***	−0.111***	−0.080***
			(0.080)	(0.020)	(0.029)
General altruism				−0.197**	−0.141**
				(0.089)	(0.060)
Risk aversion					−0.086***
					(0.031)
Time discounting					−0.177**
					(0.078)
Trust					0.073
					(0.046)
Negative reciprocity					0.058
					(0.045)
Positive reciprocity					0.034
					(0.024)
Non-medical students		0.130	0.095	0.046	0.040*
		(0.089)	(0.075)	(0.028)	(0.021)
μ					
Constant	0.770***	0.839***	0.720***	0.601***	0.627***
	(0.023)	(0.040)	(0.045)	(0.048)	(0.112)
2ND cohort		−0.001	−0.00004	0.005	−0.006
		(0.004)	(0.005)	(0.014)	(0.023)
3RD cohort		−0.013***	−0.018***	−0.048***	−0.095**
		(0.003)	(0.006)	(0.016)	(0.043)
4TH cohort		−0.006	−0.010	−0.013	−0.053
		(0.005)	(0.008)	(0.020)	(0.039)
Female			0.019***	0.040***	0.062*
			(0.006)	(0.014)	(0.034)
General altruism				0.117***	0.209**
				(0.041)	(0.106)
Risk aversion					0.034
					(0.066)
Time discounting					0.273**
					(0.117)
Trust					−0.069
					(0.043)
Negative reciprocity					−0.041
					(0.065)
Positive reciprocity					−0.022
					(0.056)
Non-medical students		−0.0004	−0.0004	−0.002	−0.018
		(0.004)	(0.006)	(0.017)	(0.030)
N	878	878	878	873	873
Log-likelihood	-6,615.2	-6,631.76	-6,624.59	-6,582.66	-6,578.67

Notes. *p<0.10; **p<0.05; ***p<0.01

E Alternative behavioral model: Fehr and Schmidt (1999)

E.1 Fehr and Schmidt parametric form for the utility function

For an alternative variant for the utility function u_i, we now consider a Fehr and Schmidt parametric form defined as:

$$u_i(s, o, \alpha_i, \beta_i) = s - \alpha_i max(o - s, 0) - \beta_i max(s - o, 0)$$

where α_i represents the penalty implied by the difference between other and self and β_i represents the penalty implied by the difference between self and other, for participant i. $\alpha_i > 0$ corresponds to aversion to disadvantageneous inequality (and $\alpha_i < 0$ corresponds to a taste to disadvantageneous inequality, being behindness averse), $\beta_i > 0$ corresponds to aversion to advantageneous inequality (aheadness aversion).

For the sake of notational simplicity, we denote $\theta_i = (\alpha_i, \beta_i, \mu_i)$ for the Fehr-Schmidt preference functional. Similarly to the estimation procedure for the CES preference functional form, the estimation procedure for the Fehr-Schmidt preference functional form accounts for parameter constraints on noise with an exponential transformation ($\mu_i = g^{\mu}(\zeta_i^{\mu}) = exp(\zeta_i^{\mu})$) of the parameter value to guarantee the noise parameter is positive. Contrary to the CES preference function, no theoretical restrictions are put on the parameters α_i and β_i for the Fehr-Schmidt preference functional and transformation functions correspond to the identity function $id()$ on $\mathbb{R}$. In vector notation, for the Fehr-Schmidt preference functional, $\theta_i = g(\zeta_i)$ with $\zeta_i = (\alpha_i, \beta_i, \zeta_i^{\mu})$ and $g() = (id(), id(), g^{\mu}())$.

The regression tables report both the regression coefficients ζ_i and the value of the transformed regression coefficients in noise ,*i.e.* when regression coefficients are transformed back to the original scale.

E.2 Aggregate estimation results for Fehr and Schmidt preferences

Table E.1 shows the estimation results with transformation of the estimated parameters into preference parameters, noise, and marginal effects. The base value of parameter α in Model (1) shows a taste for disadvantagenous inequality. Aversion to disadvantagenous inequality increases with term, with a maximum attained for clinical studies. This effect remains stable after controling for gender, altruism, preferences and personality measures. Altruist-oriented subjects display a lower aversion to disadvantagenous inequality (or higher taste for disadvantagenous inequality). The same hold for trust, positive and negative reciprocity. On the other hand, gender and discounting are associated to higher aversion to disadvantagenous inequality. The base Model (1) shows a high aversion to advantagenous inequality, as measure by parameter β. Parameter β decreases with term, with a minimum attained for clinical studies. On the opposite, gender and altruism increase aversion to advantagenous inequality. The same applies for risk aversion, discounting and positive reciprocity. Noise tends to be lower for pre-clinical students. Positive reciprocity and discounting is found to increase noise.

E.3 Random coefficient model for Fehr and Schmidt preferences

Table E.3 shows the estimation results with transformation of the estimated parameters. The base value of parameter α shows a taste for disadvantagenous inequality. Aversion to disadvantagenous inequality increases with term, with a maximum attained for clinical studies. This effect remains stable after controling for gender, altruism, but vanish when controling for preferences and personnality measures for clinical and practical. Altruist-oriented subjects have lower aversion to disadvantagenous inequality (or higher taste for disadvantagenous inequality). The same hold for trust, positive reciprocity. Negative reciprocity is no longer significant. On the other hand, gender and discounting are associated to higher aversion to disadvantagenous inequality.

Parameter β decreases with term, with a minimum attains for clinical studies. On the opposite, gender, altruism, risk aversion and positive reciprocity increase aversion to advantagenous inequality. The impact of negative reciprocity is no longer significant. Noise tends to be lower for pre-clinical students. Gender, altruism, positive reciprocity and discounting are found to increase noise.

Figure E.1 shows the distribution of observed heterogeneity implied by the different set of covariates and Figure E.2 shows the corresponding distribution of unobserved heterogeneity.

Table E.1: Aggregate estimations, preference parameters, noise, and marginal effects, Fehr and Schmidt preferences

Model	(1)	(2)	(3)	(4)	(5)	(6)
α						
Constant	-0.260^{***}	-0.346^{***}	-0.388^{***}	-0.264^{***}	-0.092^{***}	-0.105^{***}
	(0.013)	(0.024)	(0.028)	(0.041)	(0.090)	(0.093)
Pre-clinical		0.108^{***}	0.117^{***}	0.105^{***}	0.078^{***}	0.076^{***}
		(0.032)	(0.032)	(0.033)	(0.032)	(0.033)
Clinical		0.164^{***}	0.170^{***}	0.136^{***}	0.078^{***}	0.075^{***}
		(0.037)	(0.039)	(0.037)	(0.040)	(0.041)
Practical Year		0.103^{***}	0.122^{***}	0.120^{***}	0.106^{***}	0.106^{***}
		(0.049)	(0.051)	(0.056)	(0.071)	(0.075)
Female			0.068^{***}	0.084^{***}	0.089^{***}	0.075^{***}
			(0.029)	(0.029)	(0.029)	(0.030)
General altruism				-0.033^{***}	-0.019^{***}	-0.020^{***}
				(0.009)	(0.008)	(0.009)
Risk aversion					-0.006	-0.009^{**}
					(0.010)	(0.011)
Time discounting					0.041^{***}	0.043^{***}
					(0.014)	(0.014)
Trust					-0.035^{***}	-0.036^{***}
					(0.007)	(0.007)
Negative reciprocity					-0.011^{***}	-0.009^{**}
					(0.010)	(0.010)
Positive reciprocity					-0.011^{***}	-0.010^{***}
					(0.009)	(0.009)
Emotionality						0.011^{***}
						(0.008)
Extraversion						0.006^{**}
						(0.008)
Agreeableness						-0.0002
						(0.008)
Conscientiousness						0.005
						(0.008)
Openness						-0.004
						(0.007)
β						
Constant	0.970^{***}	1.105^{***}	0.954^{***}	0.687^{***}	0.557^{***}	0.493^{***}
	(0.018)	(0.042)	(0.044)	(0.060)	(0.112)	(0.137)
Pre-clinical		-0.167^{***}	-0.142^{***}	-0.114^{***}	-0.093^{***}	-0.108^{***}
		(0.051)	(0.052)	(0.055)	(0.055)	(0.064)
Clinical		-0.230^{***}	-0.223^{***}	-0.184^{***}	-0.168^{***}	-0.192^{***}
		(0.052)	(0.052)	(0.055)	(0.057)	(0.064)
Practical Year		-0.196^{***}	-0.138^{***}	-0.122^{***}	-0.050	-0.060
		(0.067)	(0.075)	(0.087)	(0.109)	(0.119)
Female			0.250^{***}	0.168^{***}	0.158^{***}	0.149^{***}
			(0.045)	(0.041)	(0.040)	(0.052)
General altruism				0.081^{***}	0.075^{***}	0.078^{***}
				(0.013)	(0.014)	(0.014)
Risk aversion					0.020^{***}	0.015^{**}
					(0.015)	(0.018)
Time discounting					0.023^{***}	0.028^{***}
					(0.015)	(0.015)
Trust					-0.003	-0.001
					(0.009)	(0.010)
Negative reciprocity					-0.011^{**}	-0.008
					(0.016)	(0.018)
Positive reciprocity					0.031^{***}	0.033^{***}
					(0.015)	(0.016)
Emotionality						0.007^{*}
						(0.011)
Extraversion						-0.002
						(0.012)
Agreeableness						-0.011^{**}
						(0.016)
Conscientiousness						0.023^{***}
						(0.015)
Openness						-0.002
						(0.009)
μ						
Constant	2.554^{***}	2.714^{***}	2.342^{***}	1.846^{***}	1.714^{***}	1.578^{***}
	(0.098)	(0.178)	(0.213)	(0.292)	(0.511)	(0.535)
Pre-clinical		-0.478^{***}	-0.316^{**}	-0.200^{**}	-0.149^{*}	-0.228^{***}
		(0.234)	(0.238)	(0.224)	(0.210)	(0.213)
Clinical		-0.282	-0.181	-0.142	-0.163^{*}	-0.206^{**}
		(0.272)	(0.272)	(0.259)	(0.257)	(0.255)
Practical Year		-0.015	0.332	0.310^{*}	0.750^{***}	0.624^{***}
		(0.348)	(0.465)	(0.473)	(0.665)	(0.648)
Female			0.493^{***}	0.147^{*}	0.164^{**}	0.189^{***}
			(0.292)	(0.213)	(0.196)	(0.225)
General altruism				0.129^{***}	0.115^{***}	0.100^{***}
				(0.044)	(0.063)	(0.065)
Risk aversion					-0.006	-0.027
					(0.062)	(0.069)
Time discounting					0.079^{***}	0.085^{***}
					(0.064)	(0.059)
Trust					-0.045^{***}	-0.041^{***}
					(0.047)	(0.047)
Negative reciprocity					-0.044^{**}	-0.019
					(0.069)	(0.069)
Positive reciprocity					0.067^{***}	0.076^{***}
					(0.060)	(0.058)
Emotionality						-0.002
						(0.042)
Extraversion						-0.045^{***}
						(0.046)
Agreeableness						0.004
						(0.059)
Conscientiousness						0.042^{**}
						(0.054)
Openness						-0.010
						(0.036)
N	733	733	733	729	729	729
Log-likelihood	-13,148.31	-12,815.62	-12,685.95	-12,176.39	-1,1797.29	-11,764.14

Notes. *p<0.10; **p<0.05; ***p<0.01

Table E.2: Random coefficient model, covariance parameter estimates, Fehr and Schmidt preferences

Model:	(1)	(2)	(3)	(4)	(5)	(6)
$\Omega_{[a,a]}$	0.127^{***}	0.124^{***}	0.123^{***}	0.120^{***}	0.109^{***}	0.109^{***}
	(0.010)	(0.010)	(0.010)	(0.010)	(0.008)	(0.009)
$\Omega_{[r,r]}$	0.272^{***}	0.256^{***}	0.234^{***}	0.207^{***}	0.204^{***}	0.205^{***}
	(0.028)	(0.027)	(0.025)	(0.022)	(0.022)	(0.022)
$\Omega_{[\mu,\mu]}$	0.530^{***}	0.536^{***}	0.516^{***}	0.505^{***}	0.461^{***}	0.465^{***}
	(0.063)	(0.065)	(0.063)	(0.062)	(0.057)	(0.058)
$\Omega_{[a,r]}$	-0.044^{***}	-0.037^{***}	-0.040^{***}	-0.031^{***}	-0.028^{***}	-0.028^{***}
	(0.011)	(0.011)	(0.011)	(0.010)	(0.009)	(0.009)
$\Omega_{[a,\mu]}$	0.124^{***}	0.129^{***}	0.122^{***}	0.125^{***}	0.106^{***}	0.103^{***}
	(0.020)	(0.019)	(0.019)	(0.019)	(0.016)	(0.016)
$\Omega_{[r,\mu]}$	0.113^{***}	0.105^{***}	0.088^{***}	0.078^{***}	0.076^{***}	0.081^{***}
	(0.025)	(0.026)	(0.023)	(0.023)	(0.022)	(0.024)
N	733	733	733	729	729	705
Log-likelihood	-4,755.7	-4,755.29	-4,757.09	-4,738.65	-4,743.42	-4,565.67
Notes.						*p<0.10; **p<0.05; ***p<0.01

Figure E.1: Distributions of parameters a, r and noise based on observed heterogeneity for the random coefficient model with different sets of covariates, Fehr and Schmidt preferences

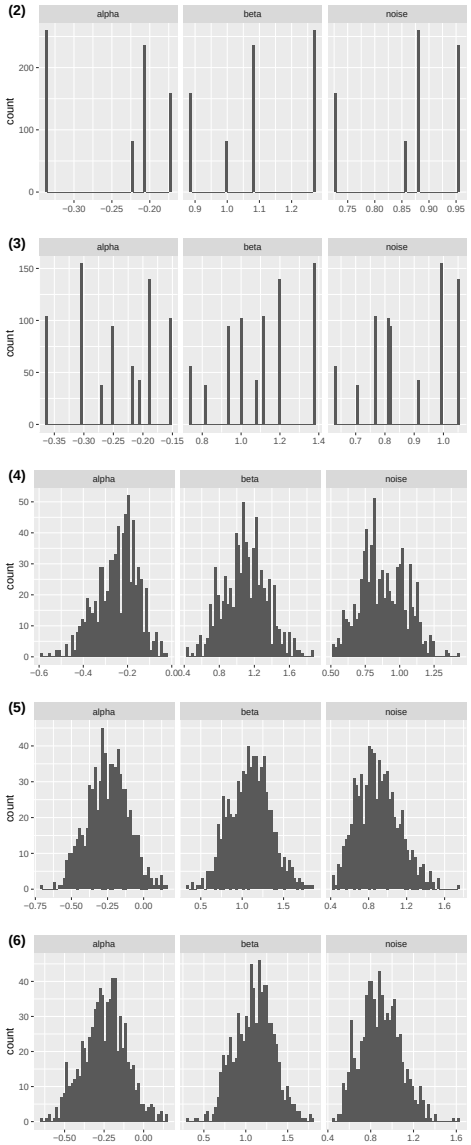
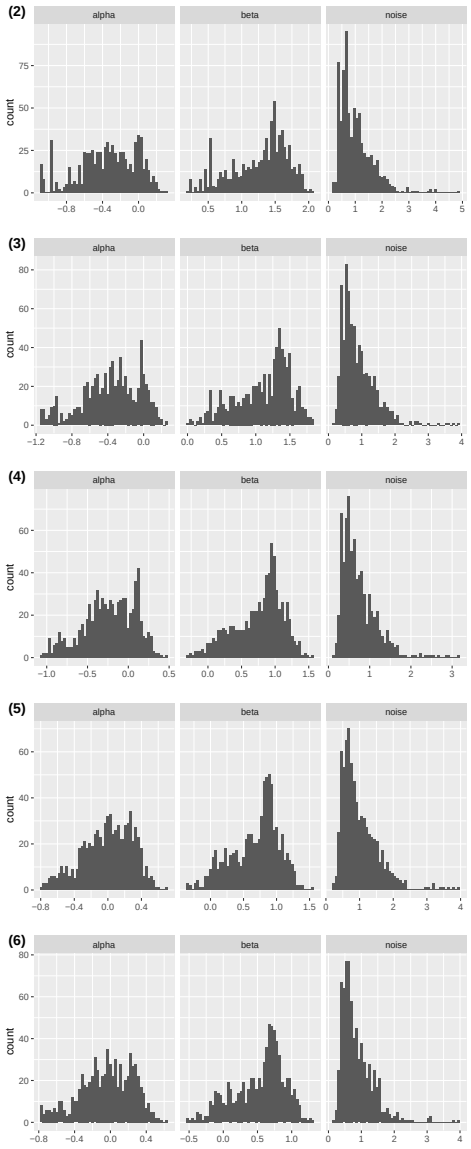


Table E.3: Random coefficient model, preference parameters, Fehr and Schmidt preferences

Model:	(1)	(2)	(3)	(4)	(5)	(6)
α						
Constant	-0.249^{***}	-0.338^{***}	-0.363^{***}	-0.214^{***}	-0.060	-0.085^{*}
	(0.015)	(0.023)	(0.026)	(0.040)	(0.067)	(0.045)
Pre-clinical		0.134^{***}	0.111^{***}	0.111^{***}	0.070^{***}	0.095^{***}
		(0.034)	(0.031)	(0.034)	(0.025)	(0.034)
Clinical		0.164^{***}	0.144^{***}	0.127^{***}	0.070^{**}	0.063^{*}
		(0.036)	(0.034)	(0.033)	(0.033)	(0.037)
Practical year		0.113^{**}	0.084^{*}	0.066	0.053	0.041
		(0.048)	(0.047)	(0.046)	(0.038)	(0.048)
Female			0.064^{**}	0.095^{***}	0.102^{***}	0.080^{***}
			(0.025)	(0.029)	(0.028)	(0.026)
General altruism				-0.417^{***}	-0.199^{***}	-0.203^{***}
				(0.083)	(0.059)	(0.073)
Risk aversion					0.025	0.042
					(0.078)	(0.072)
Time discounting					0.281^{***}	0.245^{***}
					(0.087)	(0.079)
Trust					-0.314^{***}	-0.258^{***}
					(0.058)	(0.035)
Negative reciprocity					-0.060	-0.087
					(0.072)	(0.072)
Positive reciprocity					-0.185^{**}	-0.136^{***}
					(0.081)	(0.052)
Emotionality						0.044
						(0.031)
Extraversion						0.063
						(0.041)
Agreeableness						-0.073^{**}
						(0.036)
Conscientiousness						-0.016
						(0.034)
Openness						-0.006
						(0.030)
β						
Constant	1.098^{***}	1.271^{***}	1.127^{***}	0.761^{***}	0.711^{***}	0.707^{***}
	(0.026)	(0.041)	(0.048)	(0.049)	(0.090)	(0.166)
Pre-clinical		-0.188^{***}	-0.196^{***}	-0.154^{***}	-0.150^{***}	-0.144^{***}
		(0.051)	(0.046)	(0.042)	(0.048)	(0.039)
Clinical		-0.377^{***}	-0.376^{***}	-0.318^{***}	-0.313^{***}	-0.297^{***}
		(0.057)	(0.051)	(0.045)	(0.052)	(0.062)
Practical year		-0.280^{***}	-0.308^{***}	-0.239^{***}	-0.280^{***}	-0.259^{***}
		(0.083)	(0.078)	(0.076)	(0.053)	(0.084)
Female			0.247^{***}	0.206^{***}	0.182^{***}	0.162^{***}
			(0.039)	(0.044)	(0.047)	(0.042)
General altruism				0.936^{***}	0.795^{***}	0.601^{***}
				(0.128)	(0.136)	(0.190)
Risk aversion					0.229^{***}	0.167^{*}
					(0.080)	(0.089)
Time discounting					0.047	-0.159^{**}
					(0.097)	(0.066)
Trust					0.070	0.063
					(0.066)	(0.090)
Negative reciprocity					-0.124	0.012
					(0.076)	(0.141)
Positive reciprocity					0.237^{***}	0.362^{***}
					(0.087)	(0.090)
Emotion						0.082
						(0.059)
Extraversion						0.033
						(0.047)
Agreeableness						-0.018
						(0.046)
Conscientiousness						0.049
						(0.048)
Openness						0.017
						(0.052)
μ						
Constant	0.868^{***}	0.888^{***}	0.804^{***}	0.677^{***}	0.862^{***}	0.661^{***}
	(0.035)	(0.056)	(0.067)	(0.047)	(0.115)	(0.098)
Pre-clinical		0.012	0.004	0.014	-0.002	0.020
		(0.013)	(0.010)	(0.013)	(0.012)	(0.014)
Clinical		-0.025^{**}	-0.031^{**}	-0.028^{**}	-0.057^{***}	-0.036^{***}
		(0.012)	(0.013)	(0.012)	(0.018)	(0.012)
Practical year		-0.012	-0.024	-0.023	-0.035^{***}	-0.007
		(0.015)	(0.020)	(0.018)	(0.011)	(0.013)
Female			0.032^{***}	0.042^{***}	0.050^{***}	0.041^{**}
			(0.009)	(0.012)	(0.014)	(0.016)
General altruism				0.055^{***}	0.129^{***}	0.055^{**}
				(0.020)	(0.040)	(0.023)
Risk aversion					-0.020	-0.034^{**}
					(0.023)	(0.017)
Time discounting					0.121^{**}	0.098^{*}
					(0.055)	(0.050)
Trust					-0.079^{***}	-0.024
					(0.019)	(0.021)
Negative reciprocity					-0.021	-0.012
					(0.018)	(0.011)
Positive reciprocity					-0.051^{*}	0.038
					(0.027)	(0.028)
Emotionality						0.043^{***}
						(0.013)
Extraversion						0.023
						(0.015)
Agreeableness						-0.019^{*}
						(0.010)
Conscientiousness						-0.010
						(0.009)
Openness						-0.022
						(0.018)
N	733	733	733	729	729	705
Log-likelihood	-4,755.7	-4,755.29	-4,757.09	-4,738.65	-4,743.42	-4,565.67

Notes. *p<0.10; **p<0.05; ***p<0.01

Figure E.2: Distributions of parameters a, r and noise based on unobserved heterogeneity for the random coefficient model with different sets of covariates, Fehr and Schmidt preferences



F Estimation results for patient-regarding altruism, specialty choices, and income expectations

Tables F.1 shows the estimation results for aggregate estimations and Table F.2 shows the result from the random coefficient model including medical students' expectations on their future income, as reported in the main text. The components of the Ω matrix are given in a separate Table F.3.

Table F.4 shows the most preferred stated specialty choices crossed with stage in medical studies. Table F.5 shows the estimation results for aggregate estimations and Table F.6 shows the result from the random coefficient model including the four most preferred specialities, as reported in the main text. The components of the Ω matrix are given in a separate Table F.7. Figure F.1 shows the typical indifference curves for the different specialty choice based on preference parameters from Model (1).

Table F.1: Aggregate estimations including income expectations, preference parameters a and r, marginal effects, CES preferences

Model	(1)	(2)	(3)	(4)
a				
Constant	0.266***	0.336***	0.250***	0.798***
	(0.022)	(0.030)	(0.034)	(0.112)
Expected income	0.139***	0.132***	0.107***	0.040***
	(0.030)	(0.035)	(0.033)	(0.021)
Pre-clinical			0.128***	0.073***
			(0.043)	(0.053)
Clinical			0.218***	0.094***
			(0.043)	(0.057)
Practical year			0.110***	0.082***
			(0.103)	(0.055)
Female		−0.106***	−0.095***	−0.035***
		(0.025)	(0.026)	(0.038)
General altruism				−0.041***
				(0.025)
Risk aversion				−0.009***
				(0.012)
Discounting				0.006***
				(0.009)
Trust				−0.019***
				(0.006)
Negative reciprocity				−0.006**
				(0.012)
Positive reciprocity				−0.026***
				(0.011)
Emotionality				0.004**
				(0.006)
Extraversion				0.0004
				(0.011)
Agreeableness				0.013***
				(0.010)
Conscientiousness				−0.018***
				(0.010)
Openness				−0.003*
				(0.007)
r				
Constant	−1.215***	−0.512***	−0.499***	0.081
	(0.124)	(0.142)	(0.210)	(0.393)
Expected income	0.485***	0.273***	0.211***	0.040
	(0.177)	(0.159)	(0.170)	(0.115)
Pre-clinical			0.001	0.076*
			(0.224)	(0.168)
Clinical			0.027	0.149***
			(0.350)	(0.195)
Practical year			−0.348	0.183***
			(0.769)	(0.245)
Female		−1.107***	−1.193***	−0.347***
		(0.226)	(0.257)	(0.256)
General altruism				−0.049***
				(0.066)
Risk aversion				0.011
				(0.048)
Discounting				−0.069***
				(0.056)
Trust				0.014
				(0.030)
Negative reciprocity				0.002
				(0.058)
Positive reciprocity				−0.058***
				(0.048)
Emotionality				−0.002
				(0.025)
Extraversion				−0.006
				(0.049)
Agreeableness				0.053***
				(0.044)
Conscientiousness				−0.082***
				(0.047)
Openness				0.0005
				(0.028)
μ				
Constant	2.548***	2.390***	2.088***	1.441***
	(0.121)	(0.169)	(0.216)	(0.371)
Expected income	0.001	−0.035	0.055	0.201***
	(0.182)	(0.206)	(0.201)	(0.179)
Pre-clinical			0.009	−0.123**
			(0.226)	(0.185)
Clinical			0.190	−0.052
			(0.347)	(0.212)
Practical year			1.042***	0.151
			(0.779)	(0.372)
Female		0.151	0.277***	0.070
		(0.208)	(0.216)	(0.202)
General altruism				−0.005
				(0.050)
Risk aversion				−0.033*
				(0.051)
Discounting				0.026
				(0.055)
Trust				0.011
				(0.032)
Negative reciprocity				0.014
				(0.055)
Positive reciprocity				0.080***
				(0.057)
Emotionality				−0.007
				(0.034)
Extraversion				−0.041***
				(0.046)
Agreeableness				−0.034**
				(0.058)
Conscientiousness				0.026*
				(0.040)
Openness				−0.011
				(0.032)
N	693	693	693	693
Log-likelihood	-12,467.94	-12,384.92	-12,048.49	-11,276.86

Notes. *p<0.10; **p<0.05; ***p<0.01

Table F.2: Random coefficient model including income expectations, preference parameters a and r, marginal effects, CES preferences

Model	(1)	(2)	(3)	(4)
a				
Constant	0.268***	0.316***	0.220***	0.618***
	(0.021)	(0.033)	(0.031)	(0.085)
Expected income	0.018***	0.018***	0.012***	0.015***
	(0.005)	(0.006)	(0.004)	(0.006)
Pre-clinical			0.134***	0.109***
			(0.032)	(0.033)
Clinical			0.249***	0.155***
			(0.041)	(0.039)
Practical year			0.205***	0.146***
			(0.061)	(0.045)
Female		−0.067**	−0.058***	−0.021
		(0.030)	(0.021)	(0.019)
General altruism				−0.044***
				(0.010)
Risk aversion				−0.011***
				(0.004)
Discounting				0.012***
				(0.004)
Trust				−0.021***
				(0.004)
Negative reciprocity				−0.008**
				(0.003)
Positive reciprocity				−0.017***
				(0.004)
Emotionality				0.0004
				(0.007)
Extraversion				0.001
				(0.007)
Agreeableness				−0.001
				(0.007)
Conscientiousness				−0.011**
				(0.005)
Openness				−0.003
				(0.007)
r				
Constant	−1.024***	−0.368***	−0.597***	−0.105
	(0.166)	(0.138)	(0.148)	(0.244)
Expected income	0.102	0.049	0.115	0.024
	(0.065)	(0.046)	(0.079)	(0.017)
Pre-clinical			0.015	−0.006
			(0.081)	(0.017)
Clinical			0.179*	0.028
			(0.105)	(0.019)
Practical year			0.294**	0.056*
			(0.128)	(0.030)
Female		−0.264***	−0.392***	−0.058***
		(0.056)	(0.096)	(0.021)
General altruism				−0.091
				(0.055)
Risk aversion				−0.006
				(0.033)
Discounting				−0.093***
				(0.035)
Trust				0.037
				(0.031)
Negative reciprocity				−0.024
				(0.032)
Positive reciprocity				−0.007
				(0.023)
Emotionality				−0.031
				(0.033)
Extraversion				−0.024
				(0.024)
Agreeableness				0.012
				(0.020)
Conscientiousness				−0.007
				(0.018)
Openness				0.011
				(0.015)
μ				
Constant	0.775***	0.668***	0.742***	0.587***
	(0.037)	(0.042)	(0.048)	(0.116)
Expected income	−0.002	−0.0001	−0.001	−0.006
	(0.005)	(0.005)	(0.004)	(0.025)
Pre-clinical			−0.002	0.006
			(0.004)	(0.029)
Clinical			−0.015***	−0.077**
			(0.005)	(0.037)
Practical year			−0.008	−0.051
			(0.006)	(0.034)
Female		0.022***	0.012**	0.070*
		(0.008)	(0.005)	(0.038)
General altruism				0.173
				(0.123)
Risk aversion				−0.059
				(0.073)
Discounting				0.155**
				(0.077)
Trust				−0.030
				(0.058)
Negative reciprocity				0.021
				(0.055)
Positive reciprocity				0.045
				(0.066)
Emotionality				0.043
				(0.030)
Extraversion				−0.004
				(0.035)
Agreeableness				−0.011
				(0.032)
Conscientiousness				−0.010
				(0.026)
Openness				−0.044
				(0.027)
N	693	693	693	693
Log-likelihood	-5,235.95	-5,230.15	-5,227.93	-5,216.73

Notes. *p<0.10; **p<0.05; ***p<0.01

Table F.3: Random coefficient model including income expectations, covariance parameter estimates, CES preferences

Model	(1)	(2)	(3)	(4)
$\Omega_{[a,a]}$	1.964^{***}	1.921^{***}	1.726^{***}	1.360^{***}
	(0.199)	(0.191)	(0.174)	(0.135)
$\Omega_{[r,r]}$	1.397^{***}	1.255^{***}	1.233^{***}	1.155^{***}
	(0.166)	(0.150)	(0.149)	(0.138)
$\Omega_{[\mu,\mu]}$	0.373^{***}	0.358^{***}	0.343^{***}	0.332^{***}
	(0.039)	(0.041)	(0.041)	(0.041)
$\Omega_{[a,r]}$	0.453^{***}	0.363^{***}	0.329^{***}	0.281^{***}
	(0.136)	(0.118)	(0.110)	(0.089)
$\Omega_{[a,\mu]}$	-0.237^{***}	-0.191^{***}	-0.151^{***}	-0.133^{**}
	(0.070)	(0.067)	(0.057)	(0.056)
$\Omega_{[r,\mu]}$	-0.546^{***}	-0.485^{***}	-0.463^{***}	-0.425^{***}
	(0.065)	(0.063)	(0.064)	(0.061)
N	693	693	693	693
Log-likelihood	-5,235.95	-5,230.15	-5,227.93	-5,216.73
Notes.				*p<0.10; **p<0.05; ***p<0.01

Table F.4: Descriptive statistics on stated specialty choice

	Freshman	Pre-clincial	Clinical	Practical Year	Overall
Surgery	75 (29.0%)	42 (17.9%)	15 (9.5%)	5 (6.2%)	137 (18.7%)
Internal medicine	25 (9.7%)	34 (14.5%)	30 (19.0%)	21 (25.9%)	110 (15.0%)
Pediatrics	37 (14.3%)	29 (12.3%)	22 (13.9%)	9 (11.1%)	97 (13.2%)
Neurology/psychiatry	34 (13.1%)	32 (13.6%)	13 (8.2%)	5 (6.2%)	84 (11.5%)
Others	22 (8.5%)	23 (9.8%)	9 (5.7%)	5 (6.2%)	59 (8.1%)
Orthopedics	16 (6.2%)	15 (6.4%)	17 (10.8%)	2 (2.5%)	50 (6.8%)
Anesthesia	12 (4.6%)	15 (6.4%)	15 (9.5%)	8 (9.9%)	50 (6.8%)
General medicine	11 (4.2%)	18 (7.7%)	11 (7.0%)	6 (7.4%)	46 (6.3%)
Gynecology	9 (3.5%)	7 (3.0%)	5 (3.2%)	5 (6.2%)	26 (3.5%)
Radiology/nuclear medicine	8 (3.1%)	3 (1.3%)	1 (0.6%)	6 (7.4%)	18 (2.5%)
Ophthalmology	0 (0.0%)	2 (0.9%)	7 (4.4%)	3 (3.7%)	12 (1.6%)
Dermatology	2 (0.8%)	2 (0.9%)	5 (3.2%)	3 (3.7%)	12 (1.6%)
Forensic medicine	3 (1.2%)	4 (1.7%)	2 (1.3%)	1 (1.2%)	10 (1.4%)
Otorhinolaryngology	2 (0.8%)	3 (1.3%)	3 (1.9%)	0 (0.0%)	8 (1.1%)
Urology	1 (0.4%)	3 (1.3%)	2 (1.3%)	2 (2.5%)	8 (1.1%)
Dentistry and maxillary Surgery	0 (0.0%)	2 (0.9%)	1 (0.6%)	0 (0.0%)	3 (0.4%)
Laboratory medicine	2 (0.8%)	1 (0.4%)	0 (0.0%)	0 (0.0%)	3 (0.4%)
N	259 (100%)	235 (100%)	158 (100%)	81 (100%)	733 (100%)

Notes. This table shows the most preferred stated specialty choices crossed with stage in medical studies. Specialties sorted in descending order.

Table F.5: Aggregate estimations including specialty choice, preference parameters, noise, and marginal effects, CES preferences

Model	(1)	(2)	(3)	(4)
a				
Constant	0.401***	0.448***	0.323***	0.757***
	(0.022)	(0.029)	(0.062)	(0.124)
Surgery	−0.120***	−0.076***	−0.025**	−0.027**
	(0.039)	(0.054)	(0.041)	(0.050)
Internal Medicine	−0.070***	−0.007	−0.029**	−0.010
	(0.045)	(0.049)	(0.047)	(0.031)
Pediatrics	−0.138***	−0.047***	−0.034**	−0.032***
	(0.044)	(0.059)	(0.061)	(0.041)
Neurology/Psychiatry	−0.103***	−0.071***	−0.031**	−0.020*
	(0.062)	(0.080)	(0.054)	(0.052)
Pre-clinical			0.156***	0.083***
			(0.074)	(0.048)
Clinical			0.252***	0.113***
			(0.074)	(0.051)
Practical year			0.121***	0.062***
			(0.122)	(0.071)
Female		−0.144***	−0.130***	−0.049***
		(0.032)	(0.056)	(0.041)
General altruism				−0.053***
				(0.021)
Risk aversion				−0.013***
				(0.013)
Discounting				0.010***
				(0.009)
Trust				−0.018***
				(0.008)
Negative reciprocity				0.002
				(0.018)
Positive reciprocity				−0.024***
				(0.011)
Emotionality				0.003
				(0.008)
Extraversion				0.006***
				(0.012)
Agreeableness				0.007**
				(0.013)
Conscientiousness				−0.010***
				(0.015)
Openness				0.0005
				(0.007)
r				
Constant	−0.820***	−0.492***	−0.581***	−0.462***
	(0.155)	(0.178)	(0.356)	(0.613)
Surgery	−0.311	0.131	0.195**	0.069
	(0.228)	(0.291)	(0.220)	(0.215)
Internal Medicine	−0.284	0.253***	0.189*	0.201***
	(0.289)	(0.268)	(0.294)	(0.187)
Pediatrics	−0.219	0.395***	0.422***	0.298***
	(0.266)	(0.272)	(0.269)	(0.267)
Neurology/Psychiatry	−0.199	0.133	0.282***	0.317***
	(0.317)	(0.396)	(0.288)	(0.272)
Female		−1.231***	−1.387***	−0.489***
		(0.374)	(0.536)	(0.335)
General altruism				−0.129***
				(0.098)
Pre-clinical			0.099	0.145**
			(0.390)	(0.263)
Clinical			0.082	0.307***
			(0.562)	(0.256)
Practical year			−0.167	−0.084
			(0.710)	(0.725)
Risk aversion				−0.031*
				(0.070)
Discounting				−0.090***
				(0.086)
Trust				0.055***
				(0.052)
Negative reciprocity				0.050**
				(0.128)
Positive reciprocity				−0.062***
				(0.062)
Emotionality				−0.024*
				(0.051)
Extraversion				0.020
				(0.072)
Agreeableness				0.031*
				(0.074)
Conscientiousness				−0.066***
				(0.095)
Openness				0.016
				(0.042)
μ				
constant	2.588***	2.747***	2.520***	2.157***
	(0.155)	(0.255)	(0.382)	(0.624)
Surgery	−0.072	−0.440***	−0.437***	−0.254***
	(0.241)	(0.332)	(0.282)	(0.243)
Internal Medicine	−0.052	−0.637***	−0.519***	−0.536***
	(0.273)	(0.367)	(0.324)	(0.234)
Pediatrics	−0.282	−0.796***	−0.638***	−0.464***
	(0.252)	(0.357)	(0.315)	(0.271)
Neurology/Psychiatry	0.598**	0.180	0.012	−0.182
	(0.392)	(0.599)	(0.453)	(0.312)
Female		0.113	0.235	0.013
		(0.255)	(0.421)	(0.260)
General altruism				0.028
				(0.064)
Pre-clinical			−0.176	−0.279***
			(0.375)	(0.290)
Clinical			0.248	−0.159
			(0.529)	(0.308)
Practical year			0.856***	0.834***
			(0.802)	(0.910)
Risk aversion				−0.036
				(0.085)
Discounting				0.044*
				(0.085)
Trust				−0.005
				(0.050)
Negative reciprocity				−0.011
				(0.097)
Positive reciprocity				0.053**
				(0.076)
Emotionality				−0.010
				(0.047)
Extraversion				−0.084***
				(0.073)
Agreeableness				0.001
				(0.092)
Conscientiousness				0.047**
				(0.077)
Openness				−0.020
				(0.046)
N	733	733	733	729
Log-likelihood	-13,218.83	-13,129.38	-12,807.65	-11,931.48

Notes. *p<0.10; **p<0.05; ***p<0.01

Table F.6: Random coefficient model including specialty choice, preference parameters, noise, and marginal effects, CES preferences

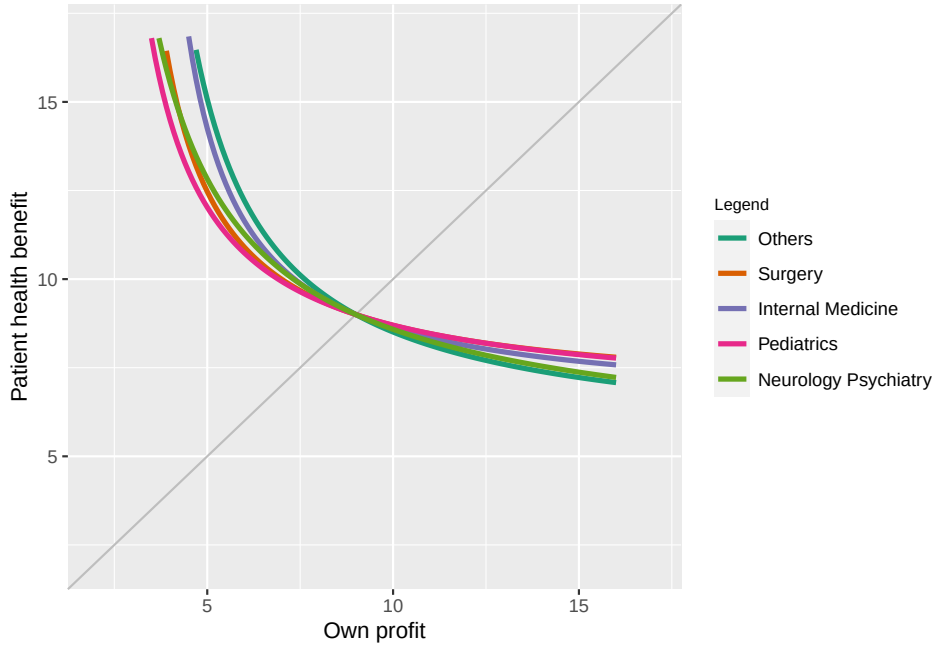
Model	(1)	(2)	(3)	(4)
a				
Constant	0.363***	0.426***	0.294***	0.612***
	(0.021)	(0.028)	(0.028)	(0.055)
Surgery	−0.022***	−0.024**	−0.010*	−0.009*
	(0.007)	(0.010)	(0.005)	(0.005)
Internal Medicine	−0.012	−0.015*	−0.012**	−0.017
	(0.008)	(0.008)	(0.005)	(0.011)
Pediatrics	−0.023***	−0.023**	−0.015*	−0.015***
	(0.009)	(0.009)	(0.008)	(0.005)
Neurology/Psychiatry	−0.009	−0.008	0.001	−0.006
	(0.008)	(0.008)	(0.010)	(0.008)
Pre-clinical			0.137***	0.110***
			(0.033)	(0.020)
Clinical			0.253***	0.168***
			(0.039)	(0.021)
Practical year			0.189***	0.135***
			(0.051)	(0.024)
Female		−0.098***	−0.084***	−0.050**
		(0.026)	(0.016)	(0.022)
General altruism				−0.043***
				(0.010)
Risk aversion				−0.018**
				(0.007)
Time discounting				0.002
				(0.009)
Trust				−0.020***
				(0.005)
Negative reciprocity				0.011**
				(0.005)
Positive reciprocity				−0.013***
				(0.005)
Emotionality				0.003
				(0.006)
Extraversion				0.006
				(0.006)
Agreeableness				−0.002
				(0.008)
Conscientiousness				−0.015**
				(0.007)
Openness				−0.003
				(0.005)
r				
Constant	−0.786***	−0.270**	−0.405***	−0.658*
	(0.138)	(0.136)	(0.150)	(0.388)
Surgery	−0.038	−0.027	−0.019	−0.014
	(0.048)	(0.044)	(0.063)	(0.019)
Internal Medicine	−0.056	−0.036	−0.080	−0.028
	(0.047)	(0.046)	(0.079)	(0.029)
Pediatrics	−0.009	0.022	0.048	0.007
	(0.061)	(0.047)	(0.075)	(0.015)
Neurology/Psychiatry	0.053	0.039	0.107	0.015
	(0.058)	(0.047)	(0.084)	(0.015)
Pre-clinical			−0.009	0.002
			(0.056)	(0.015)
Clinical			0.143**	0.038**
			(0.063)	(0.017)
Practical year			0.179**	0.054***
			(0.083)	(0.019)
Female		−0.170***	−0.315***	−0.074***
		(0.036)	(0.059)	(0.026)
General altruism				−0.053
				(0.042)
Risk aversion				−0.032
				(0.028)
Time discounting				−0.138***
				(0.047)
Trust				0.071**
				(0.033)
Negative reciprocity				0.035
				(0.022)
Positive reciprocity				0.033
				(0.024)
Emotionality				−0.018
				(0.015)
Extraversion				−0.003
				(0.016)
Agreeableness				−0.010
				(0.021)
Conscientiousness				−0.013
				(0.015)
Openness				0.003
				(0.018)
μ				
Constant	0.782***	0.691***	0.741***	0.664***
	(0.038)	(0.045)	(0.049)	(0.088)
Surgery	0.008	0.010	0.003	0.017
	(0.010)	(0.013)	(0.006)	(0.025)
Internal Medicine	0.003	0.001	0.003	0.004
	(0.010)	(0.014)	(0.007)	(0.029)
Pediatrics	−0.007	−0.016	−0.009	−0.035
	(0.012)	(0.015)	(0.008)	(0.026)
Neurology/Psychiatry	−0.023**	−0.031*	−0.020**	−0.066*
	(0.012)	(0.017)	(0.008)	(0.035)
Pre-clinical			0.0004	−0.0001
			(0.006)	(0.026)
Clinical			−0.020***	−0.086***
			(0.007)	(0.032)
Practical year			−0.006	−0.024
			(0.008)	(0.033)
Female		0.034***	0.019***	0.069**
		(0.010)	(0.006)	(0.030)
General altruism				0.152
				(0.115)
Risk aversion				−0.050
				(0.046)
Time discounting				0.244***
				(0.085)
Trust				−0.036
				(0.052)
Negative reciprocity				−0.043
				(0.070)
Positive reciprocity				−0.018
				(0.084)
Emotionality				0.029
				(0.023)
Extraversion				−0.036
				(0.028)
Agreeableness				0.009
				(0.037)
Conscientiousness				−0.009
				(0.024)
Openness				−0.027
				(0.027)
N	733	733	733	729
Log-likelihood	-5,558.94	-5,550.56	-5,556.06	-5,522.58

Notes. *p<0.10; **p<0.05; ***p<0.01

Table F.7: Random coefficient model including specialty choice, covariance parameter estimates, CES preferences

Model	(1)	(2)	(3)	(4)
$\Omega_{[a,a]}$	2.010***	1.958***	1.809***	1.517***
	(0.193)	(0.183)	(0.169)	(0.148)
$\Omega_{[r,r]}$	1.389***	1.251***	1.255***	1.186***
	(0.157)	(0.141)	(0.149)	(0.137)
$\Omega_{[\mu,\mu]}$	0.368***	0.359***	0.348***	0.334***
	(0.041)	(0.041)	(0.039)	(0.041)
$\Omega_{[a,r]}$	0.468***	0.376***	0.367***	0.339***
	(0.123)	(0.112)	(0.107)	(0.094)
$\Omega_{[a,\mu]}$	−0.224***	−0.180***	−0.157***	−0.150***
	(0.066)	(0.063)	(0.061)	(0.055)
$\Omega_{[r,\mu]}$	−0.536***	−0.484***	−0.471***	−0.436***
	(0.066)	(0.062)	(0.063)	(0.059)
N	733	733	733	729
Log-likelihood	-5,558.94	-5,550.56	-5,556.06	-5,522.58
Notes.				*p<0.10; **p<0.05; ***p<0.01

Figure F.1: Indifference curves for different specialty choices based on random coefficient model, CES preferences



Erasmus University Rotterdam
Erasmus Centre for Health Economics Rotterdam
Burgemeester Oudlaan 50
3062 PA Rotterdam, The Netherlands
T +31 10 408 8555
E escher@eur.nl
W www.eur.nl/escher