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Women across Subfields in Economics: Relative Performance and Beliefs

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¿Por qué la Economía está consolidándose como una disciplina con escasez de mujeres? Esta pregunta, aun no siendo nueva, está siendo objeto en los dos últimos años de una gran atención por parte de la profesión, especialmente en la academia. El bajo porcentaje de mujeres en la investigación académica en economía es un hecho desde hace décadas, pero, al contrario de lo que podría esperarse, dicha escasez relativa no parece haber evolucionado positivamente en los últimos años. Las tasas se sitúan entre el 20 y el 25 por ciento, dependiendo de la base consultada.

Relacionado con lo anterior, la tasa de estudiantes mujeres de economía se sitúa entre el 25 y el 40 por ciento, dependiendo del país considerado, y con tendencia a la baja. Los motivos por los que se argumenta que esto puede estar ocurriendo son variados y recurrentes, si bien la evidencia existente al respecto es todavía limitada. Algunas de las explicaciones más comunes son que: i) las mujeres no optan por carreras de contenido matemático (algo desmentido actualmente por las tasas crecientes de mujeres en matemáticas); ii) las mujeres no encuentran la economía interesante (a juzgar por encuestas pasadas a estudiantes pre-universitarios que han seguido cursos de economía en bachiller); iii) el estereotipo del economista como una figura de varón.

Las consecuencias de esta escasez relativa de mujeres en la profesión no se reducen, aun siendo muy importante, a una cuestión de igualdad de género. Una primera línea de investigación reciente pone de manifiesto que los puntos de vista sobre temas centrales en economía pueden mostrar diferencias considerables por género. Esto, junto con el hecho de que las mujeres investigadoras en economía tienden a concentrarse en ciertos temas de investigación más que en otros, puede acabar generando un sesgo bastante marcado en los temas que reciben mayor atención, y en el tipo de respuestas que reciben. Una segunda línea actual de investigación ha puesto el énfasis en la idea de que la investigación se enriquece con la diversidad dentro de los grupos que la llevan a cabo, siendo el género una de las dimensiones más destacadas de dicha diversidad.

Nuestro trabajo aporta una explicación nueva al escaso atractivo relativo que la economía parece ejercer sobre nuestras jóvenes estudiantes. En resumen, obtenemos que las áreas de investigación económica donde las mujeres tienen más presencia académica se relacionan con las áreas de estudio donde las mujeres estudiantes en la universidad obtienen mejores calificaciones en relación a los hombres. Sin embargo, justamente estas áreas son las menos conocidas por nuestros estudiantes, que tienden a asociar la mayoría de los trabajos de un economista con un macroeconomista, mayoritariamente varón.

Esta explicación surge a partir del análisis que efectuamos en tres frentes. En primer lugar, utilizamos técnicas de extracción de información web aplicadas a los trabajos presentados en el congreso anual de la American Economic Association durante años recientes. A partir de la clasificación de los trabajos según sus códigos JEL, observamos que el porcentaje de mujeres investigando en economía está en torno

al 24 por ciento, se mantiene bastante estable a lo largo de los años analizados, 2010-2016, y con una distribución desigual por áreas: cerca de un 30 por ciento en microeconomía y en torno al 18 por ciento en macroeconomía, finanzas y econometría/matemáticas. Analizando los abstracts, temas específicos como economía de la educación, laboral, de la salud, o de género presentan cerca de un 45 por ciento de mujeres, frente a un 13-15 por ciento de mujeres en temas específicos de finanzas y macroeconomía.

En segundo lugar, y constituyendo evidencia inédita al respecto, estimamos el diferencial de notas de las mujeres frente a los hombres en sus estudios universitarios de economía por áreas. Utilizando datos de registro de la Universidad de Valencia, analizamos las calificaciones obtenidas por hombres y mujeres matriculados en economía desde 2010 a 2014. Disponemos de sus notas en todas las asignaturas cursadas durante la carrera, que clasificamos en distintos campos de estudio (finanzas, macroeconomía, microeconomía, asignaturas instrumentales, y 'otras'). Controlando por su capacidad académica (notas de entrada), características del individuo como edad, situación laboral y lugar de residencia, así como por nivel educativo y tipo de ocupación de padre y madre, obtenemos claras diferencias entre hombres y mujeres en las asignaturas de macroeconomía y microeconomía. En nuestra estimación en asignaturas optativas, por cuantiles de notas, y después de aislar el efecto que pueda tener la manera en que los estudiantes realizan su selección de asignaturas, obtenemos que las mujeres superan en notas a sus compañeros varones en microeconomía, mientras que sus notas son inferiores en las asignaturas de macroeconomía. Los resultados son más abultados en los cuantiles altos de la distribución de notas.

Por último, a partir de una encuesta pasada a nuestros estudiantes de economía durante el curso 2017-2018 analizamos la información que nos proporcionan acerca de su visión de distintas asignaturas y de la propia profesión. Los resultados más llamativos se refieren a la concepción equivocada que mantienen acerca de la profesión: preguntados acerca de ocupaciones propias de un economista (trabajar en un centro de estudios/investigación, servir de asesor a instituciones públicas/privadas, hacer carrera académica, hacer oposiciones para la administración, trabajar en el sector privado) contestan mayoritariamente que los asocian a la macroeconomía, y también, en algunos de los casos, en mayor medida a hombres. Además, en mayor proporción que los hombres, las mujeres declaran encontrar la microeconomía más intuitiva, más fácil de aprobar, más preocupada por los problemas de la sociedad, más interesante en general, y declaran obtener mejores notas. También observamos que los estudiantes que declaran haber entrado con vocación en la carrera manifiestan una mayor preferencia por la macroeconomía. Por último, del estudio de las interacciones sociales dentro del aula encontramos que las mujeres son especialmente influenciables por sus compañeros varones en las asignaturas relacionadas con la macroeconomía, algo que no sucede con las asignaturas de corte más microeconómico. Esta pauta de influencias sociales es diferente de la que encontramos para los estudiantes varones, a los que sólo parece afectar el comportamiento y las preferencias de sus compañeros varones.

En definitiva, en nuestro estudio evidenciamos fallos de información por parte de los estudiantes sobre los temas a los que se dedica la economía y las salidas profesionales de las distintas áreas que configuran la disciplina. La información que llega a los estudiantes está sesgada justamente en contra de aquéllas áreas en las que comprobamos que las mujeres tienen ventaja comparativa sobre los hombres en términos de sus resultados académicos y del interés que les despiertan ciertos temas. Por el contrario, los estudiantes confieren a la macroeconomía un protagonismo dentro de la

economía que no se corresponde con su verdadero peso en el conjunto de trabajos académicos, y observamos que los estudiantes varones tienden a superar a sus compañeras mujeres tanto en resultados como en la influencia que ejercen en las asignaturas de macroeconomía. No es de extrañar, por lo tanto, que la combinación de creencias, intereses y resultados provoque que las mujeres se sientan poco inclinadas por los estudios de economía.

Women across Subfields in Economics: Relative Performance and Beliefs

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Abstract

The relative scarcity of female students enrolling in economics has become entrenched over the last decade. We provide evidence of gender differences in performance and in preferences across subfields of the discipline and explore students' beliefs about the profession and their opinions on different subjects. The areas where women stand out relative to men are those that seem to be least well known to our students. We work on three fronts. First, using web scraping and machine learning techniques, we document the relative presence of women across subfields in recent AEA annual meetings. Macroeconomics and finance register the greatest scarcity of women. Second, using administrative records for economics students in a large public university in Spain from 2010 to 2014, we find that women outperform men in microeconomics, while men outperform women in macroeconomics, more evidently in the upper tail of the grades distribution. Finally, data gathered through a self-statement survey given to economics majors reveal that (i) they hold a macroeconomics-biased view of the economics profession; (ii) they exhibit gender differences in their perceptions of the interest and difficulty inherent in different subfields (macro vs. microeconomics); and (iii) their interests and performance are influenced differently by their male and female peers in macro and microeconomics subjects. Taken together, these three pieces of evidence provide a plausible explanation as to why women are relatively less attracted than men to economics, and suggest lines of action to redress the imbalance.

Keywords: Gender, Economics subfields, Information and Beliefs.

JEL classification: A22, J16, J82, D91.

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1 Introduction

Why are there so few women in economics? This is a question that has captured the attention of economics scholars over the last few years, and one for which the profession does not have a universally-accepted answer. In this paper we look inside the discipline and explore whether women's and men's relative performance and their preferences for different subfields of economics, be they natural or socially-shaped, can help identify the areas that may be more congenial to women. Linked to this, are young students aware of the rich variety of topics covered by different subfields of economics? If the information that reaches them is skewed against fields where female students feel more comfortable, then we cannot expect women to feel particularly attracted to economics.

We provide evidence of gender differences in performance and in preferences across subfields of the discipline and explore student's beliefs about the profession and their opinions on different subjects. The areas where women relatively stand out are those that seem to be least well known to our students. We work on three fronts. First, looking at women in academia, we document their revealed preference for specific research topics as compared to men's preferences. Second, we analyze the degree to which the relative performance of women and men across subfields of economics exhibits differences even at undergraduate level. Finally, we explore students' beliefs about the profession and their opinions on different subfields, and relate them to gender interactions in the classroom .

Three complementary sources of data are used to uncover these patterns. First, using web scraping and machine learning techniques, we follow women's attendance at the annual AEA meetings in recent years. We document, first, the significant scarcity of women in the economics academic profession, and, second, the most remarkable gender differences in specific subfields. In particular, session JEL codes from 2010 to 2016 show that women account for barely 24 percent of all authors, with macroeconomics and finance being the subfields with the most severe underrepresentation, at around 18 percent on average over the period. Additionally, we dig into the abstracts to classify the papers by topics, finding sizeable differences in terms of female representation.

Second, we study if the observed differences between subfields are already being established in the early stages of the study of economics. Using administrative records for students of economics in a large public university in Spain (University of Valencia, UV henceforth), we analyze grades obtained by students from 2010 to 2014 in different subjects of the economics major, which we classify into subfields (macroeconomics, microeconomics, finance, tools and other). Our results indicate that women outperform men in microeconomics-related subjects, while men outperform women in macroeconomics-related ones. No remarkable differences are found in the rest of the subfields. These results become more noticeable when we use quantile regression to highlight differences along the grades distribution, and after controlling for self-selection of students into optional subjects through semi-parametric selection controls. The greatest relative differences between men and women are found in the upper tail of the grades distribution.

Finally, intrigued by our results revealing gender differences in performance in macroeconomics vs. microeconomics-related subjects, we analyze information from a specifically-designed self-

statement survey given to students enrolled in the economics major at UV in 2018. Both their direct answers as well as our regression results with these data reveal that: (i) students hold a macroeconomics-biased view of the economics profession, often mistakenly associating many economists' occupations with macroeconomics, while those women who stereotype economics as a macro and male-dominated profession tend to report a worse performance in macroeconomics; (ii) self-defined vocational students (those for whom economics was their first best choice) are more likely to report a higher relative preference for macroeconomics; (iii) performance in microeconomics is appreciably affected by how interesting students find this subfield, with more women than men reporting a greater interest in microeconomics than in macroeconomics; (iv) students exhibit gender differences in their preferences for the two subfields and in their self-reported relative performance that are in line with the observed distribution of women across areas of research and with the results obtained with the administrative data; and (v) both students' individual interests and their performance seem to be influenced by their male and female peers' interests and performance, with these influences exhibiting differences in macro and microeconomics subjects; among other results, we find that women's interests respond to their female peers' interests in macroeconomics, however, in terms of marks, only male students exert spillover effects on their peers' performance (both women and men) in macroeconomics classes.

Taken together, the three pieces of evidence provided in this paper suggest a subject-bias in terms of visibility, performance and perceived interest across subfields, which may be connected with the declining trend in female students choosing to study economics.

The rest of the paper is organized as follows. In Section 2, we frame our paper in the ongoing debate about the scarcity of women in economics and highlight its contribution to the literature. Then, in Sections 3, 4 and 5, we present the results from web scraping, administrative data, and economics students' self-reports, respectively. Finally, in Section 6, we summarize our main findings and conclude.

2 The ongoing debate and our contribution

In the last few years, a growing number of voices in both academia and the mass-media has been reflecting on the situation of women in the economics profession.[1] However, despite the recent resurgence of the issue, the underrepresentation of women in economics is not a new concern.

[1]In the summer of 2017, Alice Wu, caused a sort of commotion in the profession revealing the sexist comments posted on the online forum Economics Job Market Rumors (Wu, A. H., 2018, Gendered Language on the Economics Job Market Rumors Forum, in *AEA Papers and Proceedings*). The AEA President, Alvin E. Roth, charged an ad-hoc committee to evaluate various aspects of professional conduct and diversity in economics. The list of posts and articles appearing since then is becoming countless. Just to mention some examples: Justin Wolfers (University of Michigan) in *The New York Times* (https://www.nytimes.com/2018/02/02/business/why-womens-voices-are-scarce-in-economics.html, February 2, 2018); Sarah Smith, (University of Bristol, Chair of Royal Economic Society (RES) Women's Committee) in (https://www.bristol.ac.uk/efm/news/2018/still-a-long-way-to-go-a-century-on.html February 6, 2018); Anne Boring (Universiteit Rotterdam) and Soledad Zignano (Banque de France) in the *Banque de France, Eco Notepad* (https://blocnotesdeleco.banque-france.fr/en/blog-entry/economics-where-are-women July 3, 2018); Gemma C. Tetlow (UCL) in *Financial Times*, (https://www.ft.com/content/0e5d27ba-2b61-11e8-9b4b-bc4b9f08f381 April 12, 2018); other experts' concerns and opinions, for example, on the BBC-Radio, (http://www.bbc.co.uk/programmes/b01875r3/topics/Economics, Claudia Goldin (Harvard University) May 1, 2018, Stephen Machin (CEP and LSE), May 8, 2018, and Beatrice Cherrier (THEMA), May 15, 2018).

The Committee on the Status of Women in the Economics Profession (CSWEP) of the American Economic Association (established in 1971) and the RES Women's Committee (established in 1996) have been working to promote the role of women in economics for some time now. Authors such as Ferber (1995), more than two decades ago, pointed out that the low representation of women and minorities among students of economics had been noticeable for some time. The author reported that around 19 percent of PhDs in economics were earned by women in 1988-89, but ended with the optimistic prediction that "*(...), there is reason to believe that in economics, as in most other disciplines, women's progress will eventually accelerate*", (p-357).

That does not appear to have been the case. On the contrary, according to statistics on the published economists registered with the RePEc Author Service, female representation in economics academia (as of May 2018) still stands at a worldwide average of around 19 percent.[2] At the undergraduate level, worldwide figures indicate that around 25 to 40 percent of those opting for economics majors are women, with a declining trend over the last 10 years. For the US, as an example, Wolfers (2018)[3], using data from the Census Bureau's American Community Survey, reports that women made up 35 percent of economics majors in 2016, a figure about the same as in the early 1980s. Bayer and Rouse (2016), using data from the National Center of Education Statistics in the US between 1995 and 2014, calculate the percentage of women with a bachelor's degree in economics in 2014 at 28.4, a lower representation than in other social sciences, business and management, and even in STEM (science, technology, engineering and math) fields. In the UK, the Universities and Colleges Admissions Service (UCAS) cites percentages below 30 percent for female undergraduate students of economics in 2013 (after a decade of decline). In the university that is the focus of this study, UV in Spain, women enrolled in the economics major in 2017 account for 36 percent of the total.

The study of Amanda Bayer and Cecilia Elena Rouse (2016) provides a complete account of the negative consequences that the under-representation of women may have in the economics profession, as well as the possible reasons for the current gender imbalance. As the authors stress, fairness, albeit highly important, is not the only reason to care about the gender balance. They survey the recent strands of research that posit diversity within a profession as a necessary factor to ensure the highest quality of knowledge. One of the strands focuses on the difference of opinions across different groups. In economics, May et al. (2014) find that male and female economists hold different views on important economic outcomes and policies. For example, female economists differ notably from male economists in terms of their preferences about the degree of desirable government regulation, income distribution issues or labor market policies. Hence, the gender imbalance may also imply a sustained bias in the prevailing range of topics and a reduction in the diversity of points of view, which may result in negative effects on research quality.

Another line of research summarized by Bayer and Rouse, mostly based on behavioral analysis through laboratory experiments, shows that diversity changes group dynamics and decision-making. These studies find that, in general, groups with mixed gender composition develop a richer

[2] https://ideas.repec.org/top/female.html, last accessed May 23, 2018.

[3] *The New York Times* (https://www.nytimes.com/2018/02/02/business/why-womens-voices-are-scarce-in-economics.html, February 2, 2018).

interaction and a "collective intelligence" that helps them to perform better than groups lacking diversity (see, e.g., Woolley et al, 2010, or Hoogendoorn et al., 2013, and references therein).

As regards the possible reasons for the scarcity of women in economics, the authors survey both supply-side and demand-side factors alluded to in the subject literature. Among the former, we can cite: (i) the recurring explanation that math requirements inhibit women's entry into economics (although there is not in fact strong support for this justification - see Emerson *et al*, 2012 - especially given the fact that there has not been a corresponding decline in the percentage of women enrolling in math degrees); (ii) the role of previous exposure to economics, with more women than men reporting that they do not find economics interesting (Calkins and Welki, 2006, additionally report that perceived interest is a key factor determining degree choices); and (iii) the stereotypical view of economics as a male-dominated field.

On the demand-side, discrimination against women, even if it corresponds to implicit or unconscious bias reflecting existing stereotypes (see e.g., Greenwald and Krieger, 2006), is seen as one of the likely explanations. The fact that the profession is seen as a male-dominated one may have an effect not only on hiring practices, but even possibly on day-to-day interactions such as instructors giving advice to their students. Both female and male instructors may potentially exhibit such biases (Moss-Racusin et al., 2012).[4]

In this paper, we offer a new insight into the possible reasons for the gender imbalance in economics. The suspicion that there may be a subject bias in the profession, along with the likelihood of different gender preferences for different subjects/subfields in economics, provides a plausible explanation as to why women are relatively less attracted than men to economics. Our paper investigates the relative performance of women and men in different subfields of economics, and their different perceptions as regards these subfields and the economics profession. Our main finding is that women display relatively better performance and higher self-selection into microeconomics-related subjects from undergraduate level up, and that students hold a macro-biased (in part also a male-biased) view of the profession. Younger students at pre-university stages can not be expected to be better informed.[5] Hence, if young female pre-university students are not aware of the diversity of economic topics, including those in which, according to our findings, they show more interest and perform better, then it is hardly surprising that they do not feel inclined to study economics.

There may be several reasons for the lack of information and, in particular, the subject-bias of the information that reaches young students (or perhaps people in general). Topics in macroeconomics subfields are more frequently on the news and also more frequently presented to general

[4]In a recent study that has received great attention, Sarsons (2017) documents such a bias reflected in the higher penalty for coauthoring suffered by women economists, particularly if they coauthor with men. Similarly, the students themselves may be affected by the male stereotype. MacNell et al. (2015) and Boring et al. (2016) provide evidence that students rate online teachers higher when those teachers use a male name, regardless of their actual gender.

[5]Della Giusta et al. (2017), for a sample of pre-university teenage students in the UK, show how biased their perception is as regards the university majors. Also, an online survey by Economics Network administered to 1,700 UK inhabitants shows that economics is associated with aspects such as predictions, finance and business, to the exclusion of virtually everything else (https://www.economicsnetwork.ac.uk/research/understandingecon), last accessed March 23, 2018.

audiences, while many other varied and probably more specific topics analyzed by economists are not so directly publicized outside academia. Added to this, during the last decade, the global financial crisis might have helped to accentuate the visibility of some specific topics over others. Over the last 10 years, we have all become accustomed to the presence of a (more often than not male) economist in the mass-media offering an analysis of causes, consequences and predicted evolution of key economic indicators. Current university students, aged from 18 to around 22 years old, were children at the outset of the Great Recession, and have probably grown up envisaging economists in this stereotypical way.

On the other hand, as we show in Section 3 below, there is a great variety of topics that can be classified as microeconomics. It could be argued that we would need more 'key words' to illustrate what microeconomics is about than we would to convey a broad but approximate idea of what macroeconomics is about. This poses greater difficulty in convincing potential students as to how appealing (micro)economics can be. Hence, even if "economics is what economists do", it is also the case that "economists do not (only) do what people think they do".[6] If we are not able to communicate the varied and appealing areas economists deal with and, moreover, if this lack of information primarily affects a particular area of economics, then potential students that would otherwise have been attracted to those 'hidden' areas of economics may not enroll in economics majors.

Why we should care about the gender imbalance may in turn depend on the underlying causes of this imbalance. If the fact that women do not feel particularly attracted to economics is caused by an information problem, then such a scarcity may be, in turn, a symptom of other problems in the discipline. Lack of information and/or misinformation for pre-university students choosing among university majors may entail an inefficient allocation of resources, as in many other markets. Talented students may be dissuaded from enrolling in majors such as economics if they misunderstand what economics is really about and the career opportunities that this discipline opens up for them.

An additional consequence of a lack of information on particular areas of analysis within economics is that the general public will also hold not only a subject-biased but also a gendered view of the profession. If the areas of research with a higher proportion of women (see Section 3 below) and where female students perform better (Section 4 below) are less well known to the public (Section 5 below), this may affect further the visibility of female economists. Given the documented effect of female role models on gender imbalances, this may constitute a factor that contributes to sustaining gender inequality.

Moreover, the lower level, and even declining trend, of female enrollment in economics, along with the fact that they seem to self-select more into microeconomics-related areas, could accentuate the gender imbalance between subfields within economics. In some cases, such as macroeconomics and finance, we might end up with an almost entire absence of professional female economists.[7]

[6]The classic quip "Economics is what economists do" is attributed to Jacob Viner.

[7]The striking scarcity of women in some areas complicates the success of some recent initiatives such as Spanish economists and academics boycotting events without female experts. https://sites.google.com/view/nosinmujeres/inicio; last accessed May 31, 2018.

In this paper, our aim is not to offer an exhaustive exploration of the causes that may women lead to select specific areas of research or perform relatively better in some subfields, although our survey data offer some clues in this regard. Rather, our primary goal is to document the existing differences and connect them with our students' self-reported information biases.

To our knowledge, our paper is the first to provide the sort of evidence we present below, particularly in the last two parts. The information collected through web scraping adds to the scarce formal evidence provided by the literature so far as regards the areas of research where women self-select. The most similar work to this part of our paper is the study by Chari and Goldsmith-Pinkham (2017), where the authors provide information on the proportion of women in each subfield at the NBER summer meeting. We extend that information by scraping the website of the wider annual AEA meeting, and by offering detailed information on the percentage of women by research topics. As regards the results with the administrative data, to our knowledge, they represent an entirely new contribution to documenting the relative academic achievement of male and female economics students by subfields. It is particularly striking how our econometric results in this part highlight differences in the academic performance of men and women that line up with the observed worldwide trends in the choice of research areas by gender. Finally, the self-response questionnaire has been designed to find out what might be behind the econometric results with the administrative data. Since it is targeted at students in the same major and university, it uniquely complements those results.

The extent to which our results can be extrapolated to a broader scale is something we cannot categorically state. However, given that gender preferences are probably quite universal, that the curriculum of the economics major at UV is quite similar to that of other faculties and countries, and the fact that we end up observing patterns that are consistent with observations already established in the literature, we believe that our work opens up a new avenue of research that is worth exploring in other contexts.

Our results suggest reasons why women do not feel particularly attracted to economics, and point to lines of action to redress the imbalance. The main takeaway message is that economists have a communication challenge, as many voices have already expressed, and that this challenge may be particularly urgent in the case of pre-university students. Our results further support the view that this problem of information may explain part of the observed scarcity of women in economics; in addition, they point to the need to better publicize specific areas that, although they may well be highly appealing, are as yet the least well known. Our paper, then, underscores the relevance of adopting and extending projects such as CORE[8], to help fill this information gap. The misinformation also affects our students' perceptions as regards the main occupations for economics graduates and the areas of specialization that may be open to them. Economics teachers at both pre-university and university levels need to be aware of the lack of information that affects our students, and should make a conscious effort to alleviate the problem.

[8]The Curriculum in Open-access Resources in Economics (CORE) project, supported by the Royal Economic Society, is an international initiative created in 2013 as a response to concerns that the economics curriculum was becoming disconnected from the needs of learners, economics departments and employers, and also from the lived experience of potential students. https://www.ineteconomics.org/education/curricula-modules/core-project

3 Women in the AEA annual meeting and the variety of topics across subfields

To throw light on the representation of women in economics across different subfields, we look at the academic programs of the annual meetings of the American Economic Association (AEA) in recent years. For this purpose, we scrape the conference programs on the AEA website from 2010 to 2016, and the abstracts of the papers presented from 2014 to 2016. We use two different approaches. First, we classify the papers presented at AEA meetings into broad areas, according to the JEL codes of their corresponding sessions[9]. Second, we dig into the paper abstracts and obtain word clouds using a machine learning approach to classify papers by topics.

3.1 JEL approach

We extract information on the programs of the annual AEA meetings from 2010 to 2016, obtaining the JEL codes of the sessions and the names of the authors. Based on the JEL codes, papers are classified into one of the following five subfields or categories: Microeconomics (including both theoretical and empirical micro-oriented topics); Macroeconomics (also covering international economics); Finance; Tools (encompassing mathematical and quantitative methods) and Other (including a set of miscellaneous categories difficult to categorize elsewhere). To calculate the share of women, we account for the total number of authors of all papers submitted in a particular category and classify them by gender according to their first name. For this purpose, we rely on the database constructed by Tang et al. (2011), who use Facebook to collect data on first names and self-reported gender, and assign probabilities of being a man or a woman to the names[10]. We merge this database with the list of authors from the AEA meetings. Then, we assign an author as female if the probability that the name is female is higher than 0.9, and assume an author is male if the probability that the name is female is lower than 0.1[11]. Those authors who either fall within the [0.1 0.9] interval or cannot be found in the Tang et al. (2011) database are excluded[12]. Our observational unit is typically an author-paper-field-year match (author to simplify). We register 20,970 authors over the whole period, of which 5,024 (23.96 percent) are female. Of course, the same author may appear more than once in the roster.

Figure 1 shows a fairly stagnant evolution of the share of women around the average, with a minimum of 22 percent in 2011 and a maximum of 25 percent in 2014. Additionally, Figure 2 represents the evolution of the share of women across areas, where we uncover a clear gap between two research clubs: one related with Macro, Finance and Tools, which has a very low participation of female economists; and another more gender-balanced club made up of Micro & Other fields.[13] Actually, the share of women in the AEA program displays a virtually constant

[9]The complete list of these JEL codes and their correspondence with the different areas is available in Table 10 in the Appendix A.

[10]This database is also used by Chari and Goldsmith-Pinkham (2017).

[11]The average of non-classified names across all years and areas is 19.81 percent.

[12]We assume that the gender distribution by economic subfield of excluded authors is not significantly different from that of gender-identified authors. Results that include a non-classified gender category are qualitatively similar to the ones offered in the paper

[13]Tools and Other are the smallest categories by number of authors, accounting for an average of 2.5 and 12.9 percent of total authors, respectively, over the whole period.

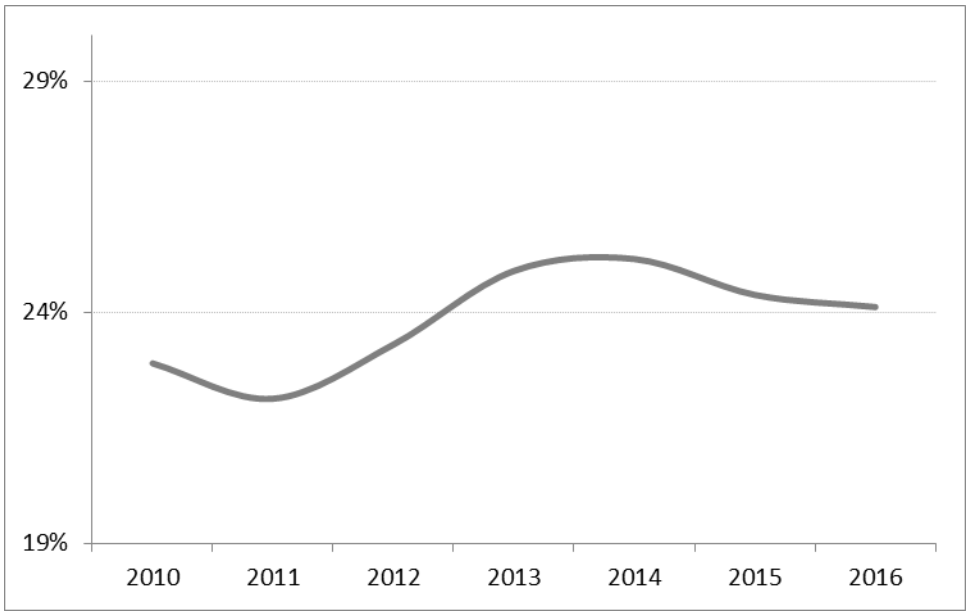


Figure 1 : *Share of women: all research areas (2010-2016)*

difference of 10 percentage points between these two broader research areas, which constitutes a considerable difference if we take into account the fact that the average female participation is around 24 percent. Depending on the year, female authors represent between 16 and 20 percent of all authors in 'Macro, Finance and Tools', and between 26 and 29 percent of total authors in 'Micro & Other'.

In a recent paper, Chari and Goldsmith-Pinkham (2017) extract information from the NBER Summer Institute sessions, over the period 2001-2016, to calculate the share of women in finance, macro & international, and micro subfields. They also find a persistent gap between subfields, with figures that are closely aligned with those we offer here for the overlapping years.

3.2 Abstract approach

Session JEL codes are quite general and may be imprecise indicators of what a paper is about; thus, the JEL approach might not be sufficiently fine-grained to capture the actual research topics covered in the meetings. To overcome this limitation, we dig into the paper abstracts and extract information using a machine learning technique. The website of the AEA meeting offers abstracts for the years 2014, 2015 and 2016. Using the Latent Dirichlet Allocation (LDA) algorithm for text analysis developed by Blei et al. (2003), we have classified the AEA abstracts by topics (or themes). The LDA algorithm offers a simple way of classifying large amounts of text (more than 5000 abstracts in this case)[14]. After some testing, we set a number of 20 topics with which to classify abstracts. We consider that the choice of 20 clouds satisfies a balance between the identification of underlying themes and the principle of parsimony.

[14]Examples of the use of this algorithm in the economics literature can be found, for example in Hansen et al. (2017) and Muller et al (2017).

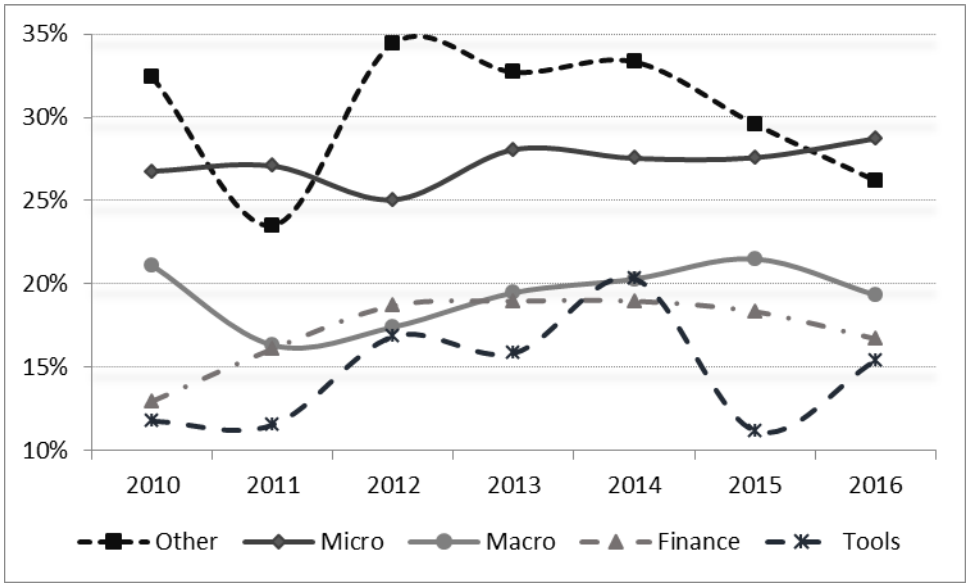


Figure 2 : *Share of women: research subfields (2010-2016)*

For a more reader-friendly presentation of the words composing each of the themes obtained, we have constructed a word cloud for each theme. Figure 3 shows the three clouds with the highest and the lowest share of women, averaging the three years for which we have information[15].

Topics related to household, gender, education and health appear as the most attractive to women, with shares ranging from 45 to 31 percent of total authors. Conversely, at the bottom of the distribution of choices, we find themes linked with theoretical econometrics, finance and macroeconomics, where women represent less than 17 percent of the authors. These results reinforce and complement our findings with the JEL approach. In both cases, they are fairly closely aligned with those obtained by Dolado et al. (2012) using a different methodology. These authors collect data from the personal websites of faculty members of the top-50 economics departments in 2005 as listed on Econphd.net. Using Econphd.net codes to classify research into different fields, they observe that topics such as wages and gender inequality, education, health and demographics are among the top female choices, with mathematical economics, fluctuations and business cycles at the other extreme.

Interestingly, our results indicate that themes conventionally aligned with macroeconomics are actually a minority. In Table 11 (in the Appendix A), we identify only two out of the twenty obtained clouds with macroeconomics (those assigned ranks 16 and 20), to which we could add three finance-related clouds (ranks 12, 14 and 19) plus two international economics clouds (ranks 7 and 15). Apart from five additional clouds that we find difficult to classify (ranks 4, 5, 9, 13 and 18), the remaining eight clouds could be classified as conventional microeconomic topics (ranks 1, 2, 3, 6, 8, 10, 11, and 17). This evidence suggests at least three ideas regarding the challenge of information communication described above. First, a fairly ample range of topics is covered by microeconomics, in contrast with the apparently prevalent idea among outsiders

[15]The complete set of clouds and the shares for each year can be found in Table 11 in the Appendix A.

that economists essentially deal with macroeconomic issues and finance. Second, the fact that microeconomic topics are highly varied and correspond to a wide set of words complicates the task of conveying in a simple and straightforward way to those outside the academia that these topics are an essential part of economics. Finally, we face two main challenges to enhancing the visibility of female economists, namely, raising the profile of the first three clouds in Figure 3 and boosting the proportion of women in the last two clouds. It would be great if young students had a good understanding of these word clouds, their true contents, the human and social problems they deal with, and, most importantly from the perspective of this paper, were aware of the presence of women in these areas of research.

The main message arising from this section is that there is considerable gender bias in the choices of research areas, which leads to an uneven gender composition across different economic subfields. In the following section, we provide evidence that this gendered inclination for specific subfields appears earlier, at the undergraduate level.

4 Relative performance across fields: results with administrative data from the University of Valencia

In this section we use UV administrative records for the period 2010-2014, to estimate the relative academic performance of male and female students across subfields. First, we present the data, then we estimate OLS and quantile regression (QR henceforth) for the students' grades in all subjects classified into subfields (macroeconomics, microeconomics, finance, tools and other), and finally we estimate QR regressions corrected for selection by means of semi-parametric methods, using the data on optional subjects.

4.1 Data

The University of Valencia, with more than 50,000 students in 2017, is one of the largest public universities in Spain. Following a formal request for information, UV provided us with data for all students enrolled in economics at UV from 2010 to 2014. For all these students we received anonymized administrative records containing information on each student's entrance grade, the educational level and employment status of their father and mother, the student's employment status, modules that the student is or has been enrolled in over the sample years, exams taken each year (per module) and the grades achieved, as well as certain demographic characteristics such as gender and age.

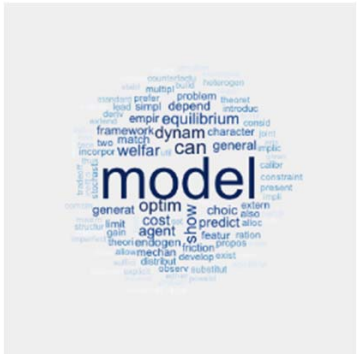
Highest Clouds			
Share of women/ No. papers	45.06% 110	33.91% 79	31.21% 69
Lowest Clouds			
Share of women/ No. papers	16.05% 68	15.22% 109	13.86% 70

Figure 3 : *Clouds of words from AEA papers' abstracts (2014-2016)*

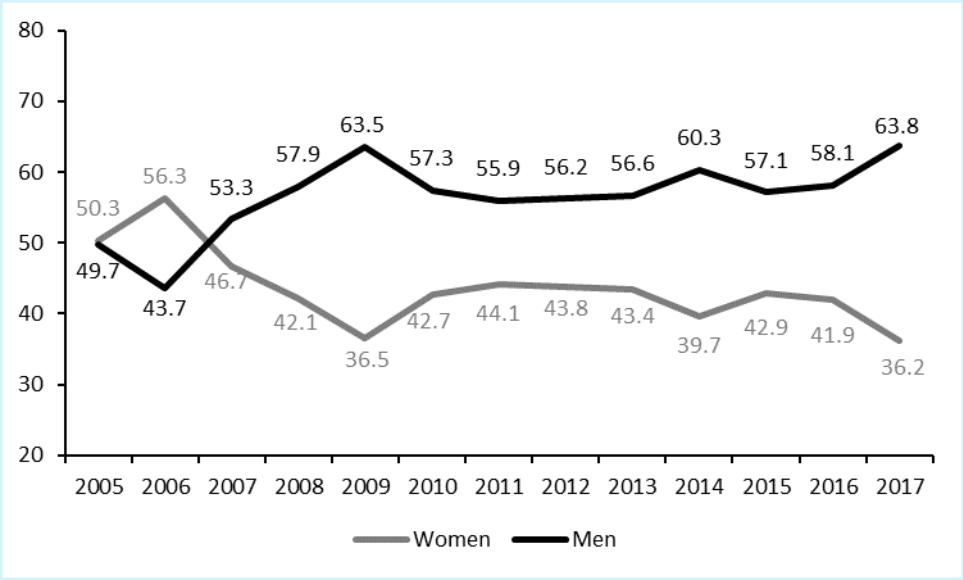


Figure 4 : *Percentages of male and female students in Economics (UV).*

In our data sample, each observation refers to one student in a given module and degree year. Each student contributes the same number of observations to our estimation sample as modules that the student is or has been enrolled in over the sample years. That is, we have not only summary information of a student's performance in a given academic year, but also their performance in all the modules they have taken over the sample period.

Figure 4 displays the trends in the percentage of students enrolled in the economics degree from 2005 to 2017 (though our estimation sample stops at 2014). The figure shows that, although the relative percentages of men and women were fairly well balanced in the years 2005 to 2007, the share of women has remained below that for men in the years since. Furthermore, and in line with what seems to be the general trend worldwide, in recent years the share of women has started to fall further and further below that of men. In the last year female students account for only 36 percent of the total.

The economics major at UV is organized around both compulsory and optional subjects. Our sample data comprises both students entering under the Bologna Program launched in 2009 and students who had entered before that year and were still studying in years 2010 to 2014. Under the Bologna Program, students need to pass 240 ECTS credits over four academic years, with an average load of 60 credits per year. Modules can have different credit loads, with the most typical being 4.5, 6 or 9 credits per module. Subjects are classified as core, compulsory or optional, and are spread out over the different years of the degrees. Optional subjects are taken in the last year of the degree and represent 20 percent of the total amount of credits in economics and business. Under the former program, the 2000 Program, students had to pass 300 credits over five years organized in a three-year first cycle (180 credits) and a two-year second cycle (120 credits). Out of the total number of credits, 30 credits corresponded to optional subjects taken over the three years of the first cycle, and 54 credits over the two years of the second cycle.

We classify all the subjects into five subfields: macroeconomics, microeconomics, finance, tools and other. The subjects included in each subfield are listed in Table 12 in the Appendix B. For each of these subfields, we estimate a regression equation of the grades obtained by each student in each and every module within the field. In a very general form, we can write our baseline regression equation for each subfield as follows:

$$G_{im} = \alpha + \beta W_i + \gamma \mathbf{x}_{it} + c_m + m_t + \iota_t + u_{im} \tag{1}$$

where subscripts i, m and t denote the student, the module, and the year, respectively; W_i is a gender dummy that takes the value 1 if the student is a women and 0 if he is a man; G_{im} denotes the grade obtained by student i in each module m of the corresponding subfield for which we estimate the equation; $\mathbf{x}_{it}$ denotes a vector of characteristics of the student and other socio-economic controls relating to their parents; c_m stands for module-specific fixed effects, m_t refers to possible time-varying module effects, ι for year-effects, and u_{im} is the error term of the equation. We pool all the observations corresponding to the same subfield across our sample years and include year dummies to control for the year effects ι_t. The term c_m refers to fixed characteristics of each module (i.e., intrinsic degree of difficulty of each module) which we estimate by module fixed effects.[16] Additionally, to control for module-year effects, m_t, (specificities of a given module in a given year, such as a change in the teacher or the difficulty of the final exam) we include the average grade of all students in the module in the year.

4.2 All subjects: OLS and quantile regression results

Each student enters the estimation regression as many times as modules they have taken in the corresponding subfield, and we only consider the final grade when the exam was passed, that is, only one observation per student and module is used. Among the variables included in $\mathbf{x}_i$ that refer to the student, we pay special attention to the score obtained by the student in the official examinations taken to gain entrance to the university (we call this the AU-score throughout the rest of the paper.[17] The AU-score is considered as a measure of the initial or innate ability of the student, and acts as a student-specific effect in the estimation. Other student-specific effects included in $\mathbf{x}_i$, some of which may vary over time, refer to age, whether they are full-time students, whether they live in the family home during the academic year and whether students come to the university from standard high schools (current high school programs), from vocational (or professional) high schools, from older high school programs or by transferring from previous university degrees. The rest of the socio-economic controls refer to the educational and economic situation of the student's parents. These are binary variables taking the value 1 whenever the parents have a given level of formal education or have a given employment status, and 0 otherwise.

[16] Command *areg* in Stata is used to absorb the module fixed effect.

[17] The AU-score is obtained by averaging the student's grades achieved at high school and the grade obtained in a specific examination compulsory for enrollment in public universities in Spain. Every year, faculties establish the minimum AU-score for enrollment in a given degree.

The information is given for the father and mother separately.

Table 1 and Table 2 display the econometric results for grades obtained by students in the different subfields. At this level, we do not distinguish between compulsory or optional subjects. For each subfield, we run an OLS regression like 1, following a sort of hierarchical regression in which we sequentially add further control variables at each step. In the upper half of Table 1 we simply regress the grades on a constant and the dummy variable for women. These results are then the closest to what teachers would observe if they simply took the average grades of their male and female students in their lists of final marks. These averages would seem to indicate that women achieve higher marks in all subfields, although the differences in these averages are not statistically significant in either macroeconomics or finance.

Next, in the bottom half of the table, we present the results after controlling for the AU-score of each student, also including the interaction term with the women dummy to allow for different effects of this variable between male and female students. The introduction of the AU-score is important in our setting, since, if the composition of the sample was biased towards, say, women having higher/lower ability than men, the observed advantage/disadvantage of women could be attributed to their different ability. Hence, this second set of results allows us to get closer to what teachers would observe if their lists of grades contained male and female students of equal ability. The estimated sign for women in macroeconomics and finance is now reversed, although the corresponding coefficients do not seem to be precisely estimated and, thus, they are not statistically significant. The positive and significant relative performance of women in microeconomics and tools holds. Qualitatively, all these results remain robust to the inclusion of the rest of the controls, as we show in Table 2, with the negative differential for women in macroeconomics now becoming statistically significant at the 10 percent level.

We then proceed in Table 3 to estimate quantile regressions (QR henceforth) to ascertain if the obtained differences are homogeneous along the grades distribution. The QR, introduced by Koenker and Basset (1978), estimates the quantiles of the conditional distribution of the response variable as functions of observed covariates. Our QR regression for each subfield can be written as follows:

$$Q_q(G_{im}) = \alpha(q) + \beta(q)W_i + \gamma(q)\mathbf{x}_{it} + c_m(q) + m_t(q) + \tau_t(q) + Q_q(u_{im}) \tag{2}$$

where Q_q denotes the conditional *qth* quantile. The QR quantiles considered are the 0.25, 0.50 and 0.75 quantiles.[18] The interpretation of coefficient estimates is essentially the same as in the median regression with the following difference: in the median regression the constant is the median of the sample, while in the QR the constant in, say, the 0.25 quantile is the 0.25th percentile for the sample.

In Table 3 the following results stand out. First, in microeconomics, female students again

[18]In particular, we have estimated simultaneous quantile regression using the command *sqreg* in *Stata*. It produces the same coefficients as standard quantile regression for each quantile but *sqreg* obtains an estimate of the VCE via bootstrapping. QR offers two advantages over the option of splitting the sample: i) it uses the entire sample information and thus does not involve a loss of degrees of freedom; and ii) it avoids the sample truncation problem which arises by splitting the data according to observed values of grades.

Table 1 : Women and men grades across subfields
(without socio-economic controls)

	ALL	MACRO	MICRO	FINANCE	TOOLS	OTHER
Women	0.078***	0.030	0.154***	0.052	0.192***	0.045***
	(0.011)	(0.040)	(0.034)	(0.039)	(0.032)	(0.013)
Const.	6.520***	6.471***	6.558***	6.405***	6.452***	6.553***
	(0.008)	(0.027)	(0.024)	(0.027)	(0.021)	(0.010)
Adj. R^2	0.156	0.047	0.069	0.063	0.048	0.231
Women	0.053***	-0.053	0.174***	-0.047	0.125***	0.022
	(0.016)	(0.059)	(0.045)	(0.056)	(0.046)	(0.019)
AU-score	0.094***	0.081***	0.133***	0.115***	0.093***	0.081***
	(0.004)	(0.016)	(0.012)	(0.017)	(0.013)	(0.005)
Women*AU-score	0.012**	0.049*	-0.009	0.059**	0.039*	0.009
	(0.006)	(0.027)	(0.019)	(0.025)	(0.020)	(0.007)
Const.	6.335***	6.321***	6.305***	6.192***	6.278***	6.388***
	(0.012)	(0.037)	(0.030)	(0.038)	(0.030)	(0.015)
Adj. R^2	0.172	0.072	0.097	0.087	0.067	0.215
N Obs.	54488	4709	7189	4271	7251	31238

Bootstrapped clustered errors by student and module in parentheses (500 replications). * p<0.10 ** p<0.05 *** p<0.01. Module fixed effects estimation. AU-score: student's score to access university (averaged grades from high school and the university access exam.

exhibit a positive and statistically significant differential in terms of grades with respect to their male coursemates. This difference is somewhat more marked in the 0.50 and 0.75 quantiles. In contrast, the corresponding differential in women's grades in macroeconomics is negative, as suggested in the previous tables, with a much more considerable and significant magnitude in the upper quantile. Thus, it seems that the differences between women and men in terms of relative performance in macro and microeconomics become clearer as we move up the grades distribution. In these upper quantiles, a difference of 0.2 points in the final grade may determine which students get a final Distinction in the module; thus, for top students, such a difference may matter quite a lot.[19] In finance, as in macroeconomics, the QR results suggest a negative differential for women with respect to men, although the effects are now significant in the 0.25 and 0.50 quantiles.

4.3 Optional subjects: selection into subfields and corrected quantile regression

In this subsection, we focus on optional modules in the different subfields. In these modules, the academic content is more specific than in compulsory or core subjects, the groups are smaller and the teachers are more specialized in the subject. Also, in optional modules, students are more likely to self-select according to their preferences. It may well be the case that the differences in

[19] According to the rules of the Faculty of Economics at UV, only 1 in every 20 students enrolled in a group can be awarded a Distinction. Students who are awarded a Distinction are then exempted from paying for one of the modules in the following academic year.

Table 2 : Women and men grades across subfields
(with socio-economic controls)

	ALL	MACRO	MICRO	FINANCE	TOOLS	OTHER
Women	0.032**	-0.098*	0.132***	-0.086	0.091**	0.013
	(0.015)	(0.057)	(0.047)	(0.058)	(0.047)	(0.019)
AU-score	0.126***	0.128***	0.163***	0.142***	0.147***	0.108***
	(0.005)	(0.017)	(0.014)	(0.017)	(0.014)	(0.006)
Women*AU-score	0.013**	0.051*	-0.008	0.064**	0.042**	0.009
	(0.006)	(0.027)	(0.020)	(0.026)	(0.020)	(0.008)
Age	-0.007***	-0.015***	-0.016***	-0.010	-0.007*	-0.004**
	(0.001)	(0.005)	(0.005)	(0.006)	(0.004)	(0.002)
Standard High-school	0.325***	0.317***	0.252***	0.314***	0.414***	0.320***
	(0.018)	(0.064)	(0.051)	(0.062)	(0.051)	(0.025)
Vocational High-school	0.072***	-0.275***	-0.083	0.093	-0.224**	0.190***
	(0.028)	(0.100)	(0.080)	(0.091)	(0.090)	(0.036)
Fulltime student	0.080***	0.087	0.119**	0.090	0.015	0.084***
	(0.017)	(0.054)	(0.049)	(0.055)	(0.047)	(0.020)
Living at home	-0.048***	-0.056	-0.113***	-0.044	-0.107**	-0.015
	(0.013)	(0.049)	(0.041)	(0.053)	(0.045)	(0.018)
Father primary educ.	0.065***	0.170***	0.056	0.017	0.044	0.065***
	(0.014)	(0.046)	(0.044)	(0.052)	(0.041)	(0.018)
Mother primary educ.	-0.012	-0.039	-0.041	0.093*	0.029	-0.025
	(0.014)	(0.046)	(0.043)	(0.050)	(0.039)	(0.017)
Father univ. educ.	0.017	0.100*	-0.103**	-0.013	-0.011	0.043**
	(0.015)	(0.059)	(0.050)	(0.058)	(0.046)	(0.019)
Mother univ. educ.	0.114***	0.066	0.168***	0.102	0.143***	0.102***
	(0.019)	(0.062)	(0.061)	(0.068)	(0.051)	(0.025)
Module averg.grades	0.272***	0.237***	0.229***	0.286***	0.193***	0.287***
	(0.013)	(0.055)	(0.037)	(0.052)	(0.039)	(0.017)
Const.	5.044***	5.508***	5.562***	5.086***	5.462***	4.795***
	(0.069)	(0.253)	(0.205)	(0.236)	(0.190)	(0.103)
Adj. R^2	0.189	0.094	0.114	0.111	0.090	0.258
N Obs.	54326	4698	7175	4261	7234	31128

Bootstrapped clustered errors by student and module in parentheses (500 replications). * p<0.10 ** p<0.05 *** p<0.01. Module fixed effects estimation. Year dummy variables included in all cases. AU-score: student's score to access university (averaged grades from high school and the university access exam.

Table 3 : Quantile regression of women and men grades across subfields

	ALL	MACRO	MICRO	FINANCE	TOOLS	OTHER
			quantile 25			
Women	-0.030***	0.012	0.081**	-0.081**	0.027	-0.045***
	(0.009)	(0.046)	(0.040)	(0.036)	(0.044)	(0.010)
AU-score	0.095***	0.065***	0.130***	0.092***	0.079***	0.089***
	(0.007)	(0.023)	(0.013)	(0.024)	(0.015)	(0.007)
Women*AU-score	0.029***	0.002	-0.026	0.061*	0.036*	0.039***
	(0.008)	(0.031)	(0.021)	(0.031)	(0.021)	(0.009)
Const.	4.430***	4.210***	3.889***	4.363***	3.811***	4.381***
	(0.019)	(0.185)	(0.123)	(0.119)	(0.133)	(0.026)
			quantile 50			
Women	0.043*	-0.061	0.155**	-0.176*	0.132*	-0.035
	(0.025)	(0.095)	(0.078)	(0.093)	(0.070)	(0.036)
AU-score	0.160***	0.137***	0.197***	0.174***	0.146***	0.153***
	(0.006)	(0.027)	(0.018)	(0.032)	(0.021)	(0.008)
Women*AU-score	0.018**	0.050	-0.007	0.074	0.045	0.027***
	(0.008)	(0.054)	(0.037)	(0.046)	(0.039)	(0.010)
Const.	4.921***	4.927***	4.286***	4.385***	4.353***	5.057***
	(0.068)	(0.216)	(0.223)	(0.304)	(0.190)	(0.118)
			quantile 75			
Women	0.075**	-0.231**	0.157*	-0.110	0.089	0.060
	(0.030)	(0.109)	(0.080)	(0.114)	(0.079)	(0.037)
AU-score	0.179***	0.169***	0.215***	0.223***	0.197***	0.161***
	(0.008)	(0.034)	(0.023)	(0.030)	(0.027)	(0.010)
Women*AU-score	0.009	0.120**	0.052	0.056	0.112***	-0.009
	(0.011)	(0.047)	(0.034)	(0.049)	(0.034)	(0.012)
Const.	5.676***	6.157***	5.396***	5.576***	5.587***	5.551***
	(0.103)	(0.397)	(0.285)	(0.337)	(0.270)	(0.138)
q25 Pseudo. R^2	0.036	0.024	0.050	0.039	0.032	0.028
q50 Pseudo. R^2	0.037	0.036	0.051	0.066	0.043	0.053
q75 Pseudo. R^2	0.047	0.042	0.053	0.067	0.052	0.053
N Obs.	54488	2334	6758	2909	5387	37335

Bootstrapped errors in parentheses (500 replications). * p<0.10 ** p<0.05 *** p<0.01. All regressions include module-year effects, year dummies and the complete set of socio-economic controls included in Table 2. AU-score: student's score to access university (averaged grades from high school and the university access exam.

women's and men's relative performance are more clearly revealed in these modules.

Students may prefer some subfields for a number of reasons. They may choose those subfields that they find easier to understand or which they find more interesting. In turn, a variety of factors may influence why a student finds a given subfield more or less interesting. For example, students' attention may be drawn to a subfield because it deals with topics that seem particularly appealing, or just because it is perceived as an area of study that will facilitate their future job search. Students may also choose optional modules on the basis of their previous results in the most closely related compulsory modules. Of course, since there is a limited number of optional modules on offer within a degree, they may also choose some modules through a process of elimination.

In addition, there may even be differences between men and women in terms of the choice of different subfields. If this were the case, we would not be able to observe differences in their relative performance because of the way they have self-selected. In fact, it is often argued that women tend to make choices more based on their performance.[20] If women dislike, say, finance and only choose it when they believe they may well get good marks in it, whereas men tend to select into finance regardless of their prospective performance, then the composition of the groups in finance could result in very similar grades even if men were better at this subject. What we are in fact aiming to capture is the extent to which women and men exhibit different relative performance that goes beyond such determinants of self-selection into specific subfields.

To shed light on the relative performance of women and men, we perform QR accounting for selection. In particular, we apply Buchinsky's (1998) method to correct for the effect of selection in QR. Basically, the method extends Heckman's (1979) classic model to allow for non-normality. In QR, since we aim to correct selection in various quantiles, we cannot restrict the analysis to a symmetric normal distribution. The Buchinsky method consists in first estimating a univariate binary-choice model through a semi- or non-parametric estimator; in a second stage, the QR for grades is estimated adding a correction term derived from the first stage.

More formally, we can define a variable s_i as a dummy variable which takes the value 1 if the student has chosen any optional subject in the f field for which we estimate the equation. The QR equation for grades can be written as follows:

$$Q_q(G_{im}/s_i = 1) = \alpha(q) + \beta(q)W_i + \gamma(q)\mathbf{x}_{it} + \tau_t(q) + c_m(q) + Q_q(u1_i/s_i = 1) \tag{3}$$

where now the quantiles are conditional on selection. The selection equation follows a semiparametric single index regression model as:

$$s_i = g(X_i'\beta_s) + u2_i \tag{4}$$

where the function g is of unknown form and $(X_i'\beta_s)$ is a single linear combination of parameters

[20] Rask and Tiefenthaler (2008) provide evidence suggesting that women demonstrate higher sensitivity to previous grades in selecting further economics courses.

and covariates thought to explain the selection.[21]

In the absence of sample selection $Q_q(u1_i/s_i = 1) = 0$, which only holds under the independence between $u1_i$ and $u2_i$. The conditional quantile of observed grades depends on the quantile-specific selection bias term of unknown form $g(X_i'\beta_s)$ which cannot be corrected using the traditional parametric estimation *à la* Heckman.[22] Instead, we use the two-step procedure suggested by Buchinsky (1998) as follows. In the first step, the parameters in the selection equation (4) are estimated using any semi non-parametric estimator. As in Sharma et al. (2013), we use the SNP estimator proposed by Gallant and Nychka (1987), which has the advantage over other semi-parametric estimators that it does not involve kernel smoothing.[23] In the second step, the QR is run on all the second stage covariates and on a polynomial expansion on the estimated linear index $(X_{if}'\beta_s)$ of the first stage. The degree of the polynomial in our QR estimation has been chosen according to the statistical significance obtained for the different powers of the index.

The linear index estimated in our SNP model comprises all the covariates already included in Table 3, including the women dummy variable. We also add as determinants of the choice of optional subjects the average grades students obtained previously in the different compulsory subjects. This reflects the plausible idea that students may choose optional subjects on the basis of how good they are at the different subfields.[24] All covariates that refer to the students themselves (age, full-time study, high school type, etc.) as well as the grades previously obtained in the compulsory subjects are interacted with the women dummy to allow us to observe whether women make their choices differently to men.

Parents' educational and employment status are not crossed with the women dummy, after having checked that no differences between men and women arose in any case in the estimated effect of these variables. These variables are not presented in the table for the sake of simplicity (and, in general, do not show significant effects in most of the cases).[25]

WWe apply the two-step procedure to each of the subfields. That is, for macro, micro, finance,

[21] A student may choose none, one or more than one module in a given subfield. Students in two modules of a given subfield will contribute two grades to the QR regression of this subfield, and will also appear twice in the selection equation in that subfield. This yields an estimation which is somewhat equivalent to applying frequency weights, that is, weighting individuals' observations according to their frequency in the sample.

[22] Parametric estimators are consistent and asymptotically efficient only if the distributional assumptions are correctly specified. Since in QR the selection bias term is of unknown form, its parametric estimation would lead to inconsistent estimates.

[23] Kernel-based methods require the choice of bandwidth, are computationally intensive and often have convergence difficulty (Stewart, 2004). The SNP is a pseudo-ML estimator where the unknown likelihood is approximated using a Hermite polynomial expansion. Identification of an SNP estimator requires fixing the value of the intercept and having at least one continuous variable in the vector of covariates. Following Melenberg and Soest (1996) the value of intercept is set to its probit estimate. Also, continuous variables are included in the estimation. See De Luca (2008) for details on the command SNP in Stata.

[24] Performance in previous economic courses by high school students is found to be a positive predictor of persistence in the discipline (Chizmar, 2000; Jensen and Owen, 2001; Calkins and Welki, 2006).

[25] It could be argued that the decisions to enroll in different fields may be interconnected. Then, the selection model could be thought of as a simultaneous equation system where the choice of one subfield depends on the previous results in that field and on the choice made about the rest of the subfields, plus additional covariates. By running separate equations, each of them can be considered as the reduced form equation from such a joint system, where the past grades in all subjects enter into each of the equations. The efficiency gain from the joint estimation of the reduced form equations is not a primary goal since our first step SNP is basically aimed at estimating the index to correct for selection in the second step.

tools and other, we estimate the non-linear selection equation and, then, the corresponding QR regression with the selection correction terms. Table 4 displays the results for the SNP estimation, while Table 5 presents the result for the QR of grades. In Table 4 a double column has been constructed that shows the baseline effect of each covariate, plus the differential effect for women. That is, the second column, labeled women (difference), in each subfield reports the coefficient of the interaction term although there is only one estimated equation in each pair of columns.

One of the most interesting findings from the SNP estimation is the different impact of past grades in macro and micro on the students' choice of the corresponding optional subjects. On the one hand, the better the past grades in macro, the higher the likelihood of a student choosing subjects in the macro, micro and finance subfields. No differences arise between men and women in this regard. However, past performance in micro seems to affect the choice of micro subjects differently in men and women. In particular, women with good marks in micro are far less likely to choose macro subjects than men: the negative coefficient for the interaction with the women dummy in the second column for macro (-1.196) almost cancels out the positive baseline effect (1.582). In microeconomics, good grades in the past make women much more prone than men to choose micro-related optional modules: the estimated effect for men is 1.253 while for women an additional 0.950 is significantly estimated.

The selection into finance also shows some differences between men and women. In particular, it seems that men are not driven by their past marks in finance to enroll in finance-related modules, whereas women are more likely to enroll in finance subjects if they previously achieved good grades in finance. Another notable result is the negative association between good marks in macro and micro and the likelihood of enrolling in the subfields of tools or other. Women with previous good grades in micro are much less likely than men to enroll in tools, while they pay much more attention than men to their past marks in tools when selecting subjects in this subfield.

Additional results in Table 4 refer to the association between the AU-score and the choice of subjects. Higher ability students, as proxied by the AU-score, tend to choose macro and tools to a greater extent, while they seem to be less attracted by finance. In the rest of the subfields, no significant effects are estimated, either for men or for women.

The women dummy variable coefficient is positive in macro and tools, which accounts for the part of the probability that remains unexplained for women as compared to men after partialling out the impact of the rest of covariates. The estimated total probability, on average, that women enter a given subfield as compared to men is not, however, uniquely defined by this dummy coefficient. To offer some results in this regard, at the bottom of Table 4 we show the average value of the estimated index ($X_i'\beta_s$) for men and the differential value for women (in particular, we run an OLS regression of the index on a constant and the women dummy). The obtained estimates indicate that the index is significantly lower for women in macro, finance and tools while the difference is positive in micro and other. As the probability increases with the index, these results indicate that women have lower estimated probabilities of entering macro, finance and tools, as compared to micro and other subjects.

Next, Table 5 presents the QR results for grades in the optional modules across subfields. For

Table 4 : Semi-Non-Parametric (SNP) estimation of optional modules choices

	Macro		Micro		Finance		Tools		Other	
	men	women (difference)	men	women (difference)	men	women (difference)	men	women (difference)	men	women (difference)
Women		1.636***		0.282		0.194		2.346***		-0.220
		(0.533)		(0.793)		(0.277)		(0.376)		(0.356)
AU-score	0.0654**	-0.0494	0.0742	-0.0229	-0.0893***	0.0745*	0.185***	-0.208***	0.00983	0.0123
	(0.0295)	(0.0411)	(0.110)	(0.116)	(0.0239)	(0.0389)	(0.0381)	(0.0530)	(0.0241)	(0.0665)
Past grades macro	2.570***	0.241	2.627***	0.0410	2.839***	0.0461	-1.689***	-0.203	-1.536***	-0.0496
	(0.158)	(0.278)	(0.419)	(0.540)	(0.195)	(0.313)	(0.527)	(0.724)	(0.306)	(0.497)
Past grades micro	1.582***	-1.196***	1.253***	0.950*	1.665***	0.0998	-2.893***	-2.595***	0.0929	0.0413
	(0.162)	(0.397)	(0.382)	(0.501)	(0.144)	(0.356)	(0.451)	(0.606)	(0.256)	(0.381)
Past grades finance	-0.224	0.488	2.515***	-2.055***	0.100	0.736*	-0.770	0.877	-0.175	0.893*
	(0.369)	(0.489)	(0.434)	(0.554)	(0.228)	(0.406)	(0.513)	(0.623)	(0.396)	(0.491)
Past grades tools	0.0639	-0.824	1.501***	-0.748	-0.371	-0.156	1.500***	1.168***	-1.276***	-0.432
	(0.370)	(0.519)	(0.285)	(0.805)	(0.228)	(0.313)	(0.0876)	(0.283)	(0.252)	(0.316)
Past grades other	0.00936	0.368*	0.0720	0.374	0.229**	-0.0425	0.367***	-0.583***	-0.172*	0.0262
	(0.127)	(0.196)	(0.268)	(0.393)	(0.108)	(0.156)	(0.140)	(0.198)	(0.101)	(0.149)
Age	0.0213***	-0.0766***	-0.0344***	-0.0421*	0.0101**	-0.0236***	-0.0190***	-0.0410**	0.0126	0.0189
	(0.00531)	(0.0203)	(0.0129)	(0.0241)	(0.00407)	(0.00907)	(0.00613)	(0.0165)	(0.0226)	(0.0123)
Living at home	-0.0544	0.0295	-0.399	0.239	-0.00370	0.0260	0.0982	-0.0259	0.0767	-0.0823
	(0.0938)	(0.128)	(0.367)	(0.448)	(0.0644)	(0.0950)	(0.0920)	(0.126)	(0.0600)	(0.0790)
Standard high school	0.175	0.164	-0.135	0.320	-0.377***	0.175	1.192***	-1.195***	0.104	-0.112
	(0.131)	(0.175)	(0.425)	(0.552)	(0.0946)	(0.152)	(0.194)	(0.245)	(0.0917)	(0.151)
Vocational high school	0.0818	0.569**	-0.807	0.489	-0.0445	0.193	0.0552	-0.476	0.0202	-0.295*
	(0.178)	(0.235)	(0.516)	(0.639)	(0.130)	(0.187)	(0.248)	(0.343)	(0.140)	(0.168)
Fulltime student	0.166*	-0.118	0.146	0.157	0.0717	-0.150	-0.0337	0.0282	0.0244	0.0185
	(0.0966)	(0.154)	(0.359)	(0.409)	(0.0681)	(0.106)	(0.0933)	(0.148)	(0.0637)	(0.111)
Constant (fixed)	-3,218		-1,311		-2,099		-1,560		1,138	
Observations	15,974		15,974		15,974		15,974		15,974	
Likelihood Ratio Test for probit vs. SNP [p-values in brackets]	37.93 [0.000]		4.61 [0.032]		106.31 [0.000]		186.82 [0.000]		13.24 [0.000]	
Log pseudolikelihood	-1199.92		-5076.24		-2716.64		-3579.03		-8101.24	

	men	women (difference)	men	women (difference)	men	women (difference)	men	women (difference)	men	women (difference)
Estimated linear index	1.154***	-0.021***	0.002	0.018*	0.394***	-0.122***	0.843***	-0.188***	0.012***	0.046***
	(0.004)	(0.006)	(0.008)	(0.010)	(0.,005)	(0.007)	(0.007)	(0.011)	(0.003)	(0.005)

Robust errors in parentheses. * p<0.10 ** p<0.05 *** p<0.01.

Table 5 : Quantile regression for grades in optional modules across subfields (with and without selection correction)

	Macro No corr.	Macro Select corr.	Micro No corr.	Micro Select corr.	Finance No corr.	Finance Select corr.	Tools No corr.	Tools Select corr.	Other No corr.	Other Select corr.
					quantile 25					
Women	-0.464	-0.770	0.158	0.147	0.090	0.188	0.181	0.132	0.000	-0.001
	(0.518)	(0.577)	(0.145)	(0.145)	(0.253)	(0.271)	(0.191)	(0.184)	(0.001)	(0.003)
AU-score	0.010	-0.163	0.202***	0.089	0.163*	0.145	0.263***	0.303***	-0.000	0.000
	(0.245)	(0.180)	(0.061)	(0.058)	(0.096)	(0.108)	(0.086)	(0.094)	(0.000)	(0.001)
Women*AU-score	0.246	0.367	-0.064	-0.021	0.031	-0.004	-0.118	-0.133	-0.000	0.001
	(0.272)	(0.308)	(0.075)	(0.067)	(0.119)	(0.135)	(0.093)	(0.092)	(0.001)	(0.003)
Constant	5.749***	5.113***	5.387***	5.521***	4.445***	4.318***	3.496***	4.296***	4.747***	4.734***
	(2.021)	(1.640)	(0.531)	(0.488)	(0.895)	(0.831)	(0.770)	(0.854)	(0.011)	(0.015)
					quantile 50					
Women	-0.763	-0.937*	0.227	0.272*	0.308	0.339	-0.085	0.024	-0.094*	-0.060
	(0.475)	(0.521)	(0.192)	(0.148)	(0.272)	(0.243)	(0.248)	(0.230)	(0.056)	(0.050)
AU-score	0.089	-0.079	0.238***	0.140**	0.310***	0.262***	0.193**	0.258***	0.106***	0.052
	(0.277)	(0.178)	(0.068)	(0.061)	(0.077)	(0.058)	(0.087)	(0.077)	(0.036)	(0.032)
Women*AU-score	0.207	0.259	-0.002	-0.054	-0.146	-0.113	0.056	-0.113	0.060	0.061
	(0.267)	(0.244)	(0.095)	(0.088)	(0.140)	(0.097)	(0.133)	(0.126)	(0.041)	(0.041)
Constant	6.290***	6.586***	6.243***	6.554***	4.888***	4.816***	4.536***	5.141***	4.894***	4.673***
	(1.926)	(1.466)	(0.753)	(0.656)	(0.809)	(0.672)	(0.901)	(0.857)	(0.212)	(0.167)
					quantile 75					
Women	-0.536	-0.869**	0.386*	0.454**	0.152	0.202	0.027	-0.171	-0.044	-0.079
	(0.712)	(0.414)	(0.210)	(0.212)	(0.324)	(0.246)	(0.242)	(0.227)	(0.075)	(0.083)
AU-score	0.259	-0.072	0.251***	0.161**	0.163**	0.156***	0.230***	0.281***	0.177***	0.083***
	(0.183)	(0.197)	(0.062)	(0.065)	(0.067)	(0.056)	(0.088)	(0.091)	(0.027)	(0.024)
Women*AU-score	0.116	0.168	-0.056	-0.118	-0.052	-0.086	0.015	-0.056	0.004	0.066*
	(0.365)	(0.185)	(0.085)	(0.082)	(0.164)	(0.096)	(0.114)	(0.110)	(0.032)	(0.036)
Constant	7.781***	7.934***	7.402***	7.278***	6.657***	6.199***	6.902***	6.371***	5.179***	4.486***
	(1.918)	(1.586)	(0.735)	(0.628)	(0.887)	(0.827)	(0.895)	(0.888)	(0.266)	(0.279)
N Obs	256	256	1373	1373	735	735	1048	1048	12511	12511

Bootstrapped errors in parentheses (500 replications). * p<0.10 ** p<0.05 *** p<0.01. All regressions include module-year effects, year dummies and the complete set of socio-economic controls included in Table 2. AU-score: student's score to access university (averaged grades from high school and the university access exam.

the sake of comparison, we offer the regressions with and without correction for selection.[26] First, the results confirm the previous finding that women perform better than men in micro while performing relatively worse in macro-related subjects. The correction for selection has two effects on these results: the magnitude of the estimated coefficient for the women dummy is larger in both the micro and the macro equations, and the precision of these estimates increases, at least in the 0.50 and 0.75 quantiles. As a result, in the 0.50 quantile, the uncorrected coefficients (negative in macro and positive in micro) turn out to be statistically significant at the 10 percent level when corrected for selection. In the upper quantile, the differences are very clear, both in magnitude and in terms of statistical significance. In macroeconomics, women (when the covariates have a value of 0) obtain average grades that are almost 0.9 points below the grades obtained by men. In contrast, in microeconomics women outperform their male mates by around 0.5 points. It is important to emphasize here that these are not differences that teachers could easily observe in their lists of grades. Instead, these are the differences that would show up if the groups of students were composed of students that are broadly comparable with respect to a list of characteristics, including their innate ability and the reasons why they enroll in these subfields.

The fact that the differences are more evident in the upper part of the grades distribution seems, on the one hand, logical, and, on the other hand, makes the obtained results even more relevant. The upper tail of the distribution of grades is where the level of competitiveness between students is expected to be the highest, and thus, where the natural differences, in terms of ability and preferences between men and women, if they exist, will show up more clearly. In addition, a positive/negative difference in this upper tail gives the individual the self-confidence that he or she is notably better at some subjects than at others. This effect may condition male and female graduates' choice of future occupations, particularly if, as our results above suggest, individuals link their choices to their previous performance. It can also be the case that employers seek to hire or select graduates drawing from this upper part of the distribution. By way of example, students planning to follow a postgraduate course or to undertake a PhD may be selected by supervisors on the basis of their marks in specific subjects. The observation that there are more men in macro-related occupations and more women in micro-related ones could then be a consequence of these results.

5 Survey given to economics students: their opinions and beliefs

In this section, we present the results from the self-statement questionnaire given to students of economics enrolled at UV in February of academic year 2017-2018. First we describe the survey design and present the main information at a descriptive level, then we conduct OLS and IV estimation of the determinants of students' self-reported interests and performance in macro and microeconomics subjects. Finally, we estimate peer effects to highlight the social interaction of male and female students in macro and microeconomics classes.

[26] The correction for selection is statistically significant in all subfields, and the choice of the order of the polynomial on the index ($X_i'\beta_s$) is made on the basis of how many powers are significant in the OLS regression on the median. This corresponds to results in Table 13 in the Appendix.

5.1 Survey design and self-reported statements about subfields and the economics profession

Intrigued by our results revealing the different relative performance of male and female students in macro and micro subjects, we surveyed students of economics enrolled at UV in the academic year 2017-2018. Our purpose was to inquire into their opinions about the two subfields of macro and microeconomics and to gather information on their beliefs about the economics profession. An anonymous questionnaire was given to students in class time with the collaboration of the teachers of the compulsory subjects of the first, second and third year of the economics degree.[27] The response rate is the number of students attending classes the day the survey, which was not announced in advance, was given out (N=307).[28] Besides their opinions about macro, micro and the profession, they were also asked questions concerning themselves and their parents' education and jobs. More specifically, a first group of these questions relate to the students' gender, AU-scores, whether or not they had considered other alternatives to the economics major before entering the university, the type of high school they come from, as well as questions about their parents' socio-economic characteristics, coinciding with the categories in the administrative data we use in Section 4.

To gather the students' opinions about macroeconomics and microeconomics, we asked them to declare which of these two subfields they found to be more intuitive, more aligned with social problems (we call this indicator social concern), technically more complex and more difficult to pass. Two additional questions in this group were of particular interest to us: first, whether students find either macro or micro a more interesting subfield than the other; and second, in which subfield they obtain better grades. They could also take a neutral position and answer 'both equally'.

In Table 6 we show the students responses. First, we present OLS results for several dependent variables constructed as binary indicators taking the value 1 if the student rates a given subfield (macro or micro) as more clearly intuitive, technically complex, difficult to pass, etc. For example, the first two coefficients in the first column of the table are the OLS estimates for the constant and the women differential effect for a dependent variable that takes the value 1 if the student responds that macroeconomics is more intuitive than micro, and 0 if the student responds instead that micro is more intuitive than macro or that they believe both are equally intuitive. The estimated constant in each case measures the percentage of male students that choose the characteristic denoted at the top (intuitive, complex, and so on) as more connected to macro or micro, while the estimated women difference should be added to the constant to determine the percentage of women that choose that answer (those who take a neutral position make up the difference to 100 percent).

We can sum up our results as follows. The percentage of men that find macroeconomics more

[27] As all subjects in the fourth year are optional, it is difficult to find all students of a group sitting in the same classroom. However, some students sitting, for example, the third-year classes may already be enrolled in some fourth-year courses. Those students have been asked in which year of the degree they have the bulk of their credits during the current year.

[28] The response rate is around 70 percent, a total of 9 groups were surveyed and the share of women is around 46 percent, somewhat greater than the actual percentage of enrolled women, suggesting that absenteeism among women might be lower.

intuitive, more technically complex and more difficult to pass and the percentage of men that believe these characteristics to be more closely linked to micro are fairly similar (roughly 30 percent for both macro and micro). However, women significantly find macroeconomics more technically complex and more difficult to pass than men, while women are more likely than men to answer that micro is more intuitive than macroeconomics (around 32 percent of men as compared to nearly 46 percent of women). As regards which subfield is more closely aligned with important problems in society (the variable we call *social concern*), our students rate macroeconomics clearly above microeconomics, and women do not differ from men in this statement. In the case of the more general question of which subfield is found to be more interesting, it also seems that macro is preferred by both men and women, although in this case women exhibit a differential positive answer in micro and negative in macro with respect to men that is statistically significant. Finally, as regards their performance in the two subfields, a much higher percentage of men respond that they obtain better grades in macroeconomics (nearly 41 percent as compared to the 14 percent that claim to obtain better grades in micro). The percentages of women stating better grades in either micro or macro are quite similar (a total of 26 percent in macro and around 22 percent in micro) but relative to men, their self- stated performance is statistically worse in macro and better in micro.

This first set of results, thus, reveals that both women and men find macroeconomics an interesting subfield that deals with important societal problems to a greater extent than microeconomics, though women are more likely than men to choose micro as a more interesting subfield, and the opposite holds for macro. This does not mean that women find macroeconomics less interesting than microeconomics; it is just that they find it less so than men do. For reasons we are not able to identify, women find micro less difficult and more intuitive than macro, but, interestingly enough and in spite of this, they report similar performance in micro and macroeconomics. Unlike women, men exhibit more skewed answers towards a relatively better performance in macro. Thus, according to their own statements, women do not exhibit a particular preference or an absolute advantage in microeconomics as compared to macro but, instead, they clearly hold a comparative advantage/disadvantage in micro/macro as compared to men.

In the second half of the table, we repeat these OLS results controlling for students' ability (AU-score) and the rest of the controls. We also include the academic year in which the student is currently studying. This conditional estimation basically confirms the differential effects exhibited by women with respect to men outlined above, since the estimated coefficients of the women dummy variable are broadly comparable both in magnitude and in their statistical significance.[29] Besides this, students in their second and third-or-fourth academic years find macroeconomics more intuitive, more interesting and obtain better grades in macroeconomics than in their first year, while the reverse applies to microeconomics. In both cases, macro and micro, students find them more technically complex in the higher-level courses, while micro is found to be more difficult to pass and macro easier as the degree advances. Finally, in the higher-level courses, students more

[29]Here the constants no longer admit the same interpretation as in the upper half of the table. They are now the proportion of men that chose that option when all the rest of the covariates have a value of 0 (including age, for example, which cannot be zero).

often respond that they believe macro to be more interesting than microeconomics.

Next, to assess the students' beliefs about the economics profession, we presented them with a list of seven possible occupations of an economist. For each one, we asked students to report their opinion concerning two aspects: first, whether they personally more clearly associate each of these occupations either with macroeconomics or with microeconomics (or both equally); and second, whether each of these occupations is perceived as a male or a female job (or, alternatively, no gender bias). The seven occupations listed refer to jobs in: 1. A research/advance-study center in Spain; 2. A research/advance-study center abroad; 3. Banking and/or Finance sector. 4. PhD to become an academic or university teacher. 5. Advisor in institutions (public or private). 6. Private sector. 7. Public service (through official examinations). Students were also allowed to specify any 'other' job they might contemplate. We believe that most would agree that the list itself is neither field-biased nor gender-biased.

The students' answers as regards their perception of the listed occupations reveal that their beliefs about the economics profession are affected by subfield and gender biases. These answers are shown in Figures 5 and 6. The first figure illustrates the percentage of students that associate each of the listed jobs either with macro or with microeconomics (or neutral). The data reveal, in our view, some clear mistaken beliefs held by students in this regard. For example, they associate jobs in advanced-study and research centers more with macro than with micro, and even more with macro than with 'both': around 52 percent and 64 percent, respectively, make such an association, against 10 percent and 3.6 percent that regard these two occupations as more connected with microeconomics. Becoming an advisor in institutions, no matter if they are public or private, is also prominently associated with macroeconomics (65 percent of students believe this, against 24 percent that associate it with both subfields, and 7.8 percent that link it to micro). The banking and finance sector is again more strongly associated with macroeconomics. The private sector is the only case where microeconomics clearly outnumbers macroeconomics (78 percent of respondents connect it more clearly to micro). Finally, micro is approximately equal to macroeconomics as a subfield that is specific to jobs in the public sector obtained by sitting official examinations, and again, curiously enough, microeconomics is somewhat more associated with following a PhD and becoming university academics and teachers (18 percent for micro as compared to 12.7 percent for macro).[30]

At least three concerns arise from this information. First, the economics profession is viewed as dominated by macroeconomics in most of economists' more natural occupations. The many interesting fields where microeconomists work and their relevance in providing advice to public and private institutions do not seem to reach our students. Second, this imperfect information is predictably much more pronounced among young students before their choice of major. Those not particularly attracted by macroeconomics are very unlikely to feel attracted by economics, in part due to the lack of appropriate information as regards the many topics that microeconomics

[30]In general, no significant differences between women and men emerge in these answers, so we do not offer them separately by gender. The only statistically significant differences are that 4 percent (p-value=0.072) and 6 percent more women (p-value=0.027) find jobs in research centers abroad and jobs in finance and banking, respectively, to be more associated with women, and 12 percent more women (p-value=0.038) regard jobs in research centers abroad as more associated with macroeconomics.

Table 6 : STUDENTS' SELF-STATEMENTS ABOUT SUBJECTS IN MACRO AND MICRO
"I FIND SUBJECTS IN THIS SUBFIELD MORE..."

	Intuitive	Technically complex	Difficult to pass	Better grades	Socially concerned	Interesting
MACRO						
Woman (difference)	0.003	0.163***	0.168***	-0.142***	-0.0229	-0.112**
	(0.053)	(0.055)	(0.054)	(0.053)	(0.056)	(0.037)
Constant (averg men)	0.307***	0.337***	0.283***	0.410***	0.614***	0.626***
	(0.035)	(0.036)	(0.035)	(0.038)	(0.037)	(0.038)
MICRO						
Woman (difference)	0.132**	-0.115**	-0.118***	0.073*	0.059	0.065*
	(0.055)	(0.049)	(0.045)	(0.044)	(0.043)	(0.035)
Constant (averg men)	0.325***	0.319***	0.259***	0.145***	0.145***	0.090**
	(0.036)	(0.036)	(0.034)	(0.027)	(0.027)	(0.027)
MACRO						
Woman (difference)	0.026	0.135**	0.130**	-0.111**	-0.034	-0.114**
	(0.052)	(0.056)	(0.055)	(0.050)	(0.057)	(0.056)
Constant	0.301	0.767**	0.627**	0.067	0.556*	0.548*
	(0.240)	(0.300)	(0.245)	(0.264)	(0.312)	(0.303)
AU-score	0.002	-0.008	0.004	0.0113	0.008	0.017
	(0.016)	(0.020)	(0.018)	(0.016)	(0.020)	(0.019)
Age	-0.007	-0.011	-0.013**	-0.001	-0.001	-0.011
	(0.006)	(0.007)	(0.005)	(0.007)	(0.009)	(0.009)
Year 2	0.331***	-0.256***	-0.318***	0.517***	-0.007	0.298***
	(0.069)	(0.069)	(0.060)	(0.064)	(0.074)	(0.067)
Year 3	0.117*	-0.099	-0.038	0.285***	0.042	0.187***
	(0.061)	(0.067)	(0.069)	(0.059)	(0.071)	(0.070)
F-test controls	yes	yes	yes	yes	yes	yes
p-values	0.708	0.590	0.250	0.865	0.504	0.927
MICRO						
girl	0.116**	-0.110**	-0.075*	0.068*	0.067	0.061*
	(0.055)	(0.049)	(0.042)	(0.035)	(0.044)	(0.035)
Constant	0.903***	-0.139	-0.038	0.745***	0.162	0.316
	(0.299)	(0.250)	(0.263)	(0.239)	(0.237)	(0.220)
AU-score	-0.034*	0.033**	-0.001	-0.038**	-0.008	-0.008
	(0.017)	(0.015)	(0.013)	(0.018)	(0.015)	(0.017)
Age	-0.004	-0.001	0.00774	-0.008*	0.00477	-0.004
	(0.009)	(0.007)	(0.009)	(0.004)	(0.007)	(0.003)
Year 2	-0.323***	0.257***	0.424***	-0.102*	-0.0397	-0.122***
	(0.066)	(0.066)	(0.064)	(0.052)	(0.057)	(0.041)
Year 3	-0.170**	0.206***	0.068	-0.034	-0.087*	-0.058
	(0.071)	(0.057)	(0.046)	(0.057)	(0.052)	(0.048)
F-test controls	yes	yes	yes	yes	yes	yes
p-values	0.064	0.398	0.309	0.563	0.296	0.955
N Obs	307	307	307	307	307	307

Robust standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.01. Controls are the socio-economic variables included in Table 2. AU-score: student's score to access university (averaged grades from high school and the university access exam.

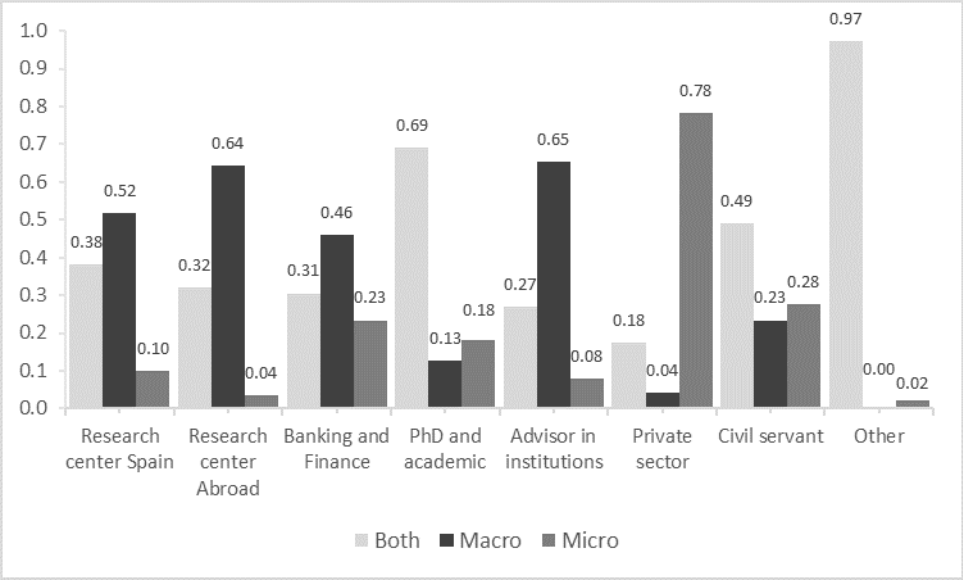


Figure 5 : *Students' association of jobs with MACRO vs MICRO*

deals with. And, third, if microeconomics is particularly associated with only the private sector (probably viewed as merely dealing with firms' and consumers' decisions) it then follows that business majors offer a natural alternative for those who think they will enjoy microeconomics more.[31]

Moving to Figure 6 we can observe the students' beliefs about the gender bias of the different types of occupations. A first observation to note here is that, in all cases, the highest percentage corresponds to students that find the job equally associated with women and men. In any case, when students side with any gender, it is more often a man than a woman in most of the occupations: in two out of the seven cases (finance and advisor to institutions) more than 40 percent of students find the job to be particularly associated with a male figure (vs. 6.5 percent associating it with women), and in three out of the remaining five jobs, around 20 percent of students provide the same answer (no more than 6 percent associate them with women in any case). In only two out of the seven occupations, women are slightly more salient: following a PhD and becoming an academic/university teacher, and sitting official examinations to work in the public sector. These are the two jobs in the list that probably entail a lower perceived risk and greater stability, namely, a teacher (albeit a university lecturer) and a civil servant. We find it quite curious that the two occupations least clearly associated with macro are precisely those that are more closely associated with women.[32]

Thus, for many of our students, their overall perception of the profession seems to be one

[31] At UV the percentage of women in business majors is slightly above 50 percent. Since we do not have information on students before they choose their majors nor on students that have decided not to enter economics, we cannot ascertain the extent to which these misperceptions about the profession may affect such decisions. Very likely, though, their understanding of the economics field is even worse in such cases.

[32] Social psychologists point out that individuals' assertions when asked about specific biases tend to hide the true ones. To overcome this recognized problem, psychologists carry out *Implicit Association Tests*, IAT, designed to detect the strength of a person's automatic association between objects or ideas (Greenwald et al., 1998)

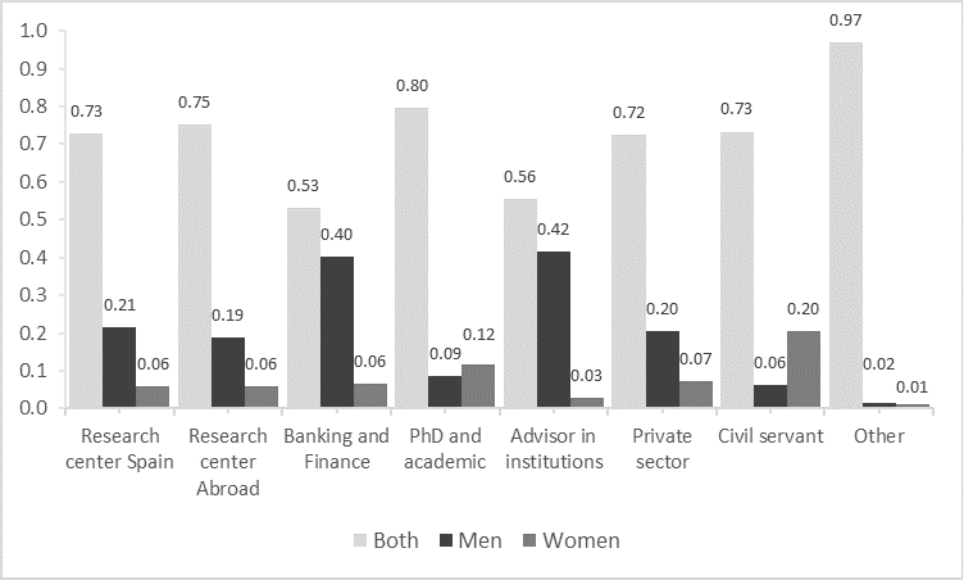


Figure 6 : *Students' association of jobs with MEN vs WOMEN*

that offers greater opportunities for macroeconomists, particularly if they are men. It is difficult to see how such an environment could be congenial to women. Not only do they not belong to the dominant gender in some of the most visible occupations of the profession, but nor do they have a relative advantage in or preference for the dominant subfield, macroeconomics. The most disturbing fact, however, is that some of these established stereotypes respond to mistaken beliefs about the profession. It seems, for example, that the important role of microeconomics in providing advice to policymakers in the areas of education, health, energy, industry or labor is not clearly understood by our students. Policy advice in these areas is viewed as a task carried out by macroeconomists. The data also reveal a considerable misunderstanding of the job opportunities offered by the profession, as well as how the subfields they study in the degree translate into specific occupations in the labor market.

5.2 Relationship between perceptions, interests and grades

We now extend some of the baseline regressions offered in Table 6 by incorporating a full set of covariates. In particular, we focus on the indicator variables revealing which field students find more interesting and in which subfield they claim to obtain better grades. Our goal here is to find out how these answers correlate with other self-reported statements by the students regarding themselves as well as their beliefs about the profession. We proceed as follows. For each subfield, we estimate a linear probability model (LPM henceforth) for the dependent binary indicator I_{if} equal to 1 if the *i-th* student states "*I find subfield f more interesting* (f=macro, micro)" and 0 if the student reports that the other subfield is more interesting or takes a neutral position. The estimation equation takes the form:

$$I_{if} = \alpha + \beta W_i + \delta \mathbf{z}_i^I + \gamma \mathbf{x}_i + \tau_t + u_{if}^I \qquad \forall f \tag{5}$$

where W_i is the women dummy variable. The vector $\mathbf{z}_i^I$ contains the student's answers to other questions of the survey that we consider may correlate with the perceived interest in the subfield: a dummy variable that equals 1 for those who declare the subfield to be more closely linked to social problems; a dummy variable identifying those for whom economics was their first best option among all the university degrees (*initial vocation*); a quantitative variable counting how many jobs the student perceives as macro-oriented (we call this the "*Jobs-macro*" belief); a quantitative variable counting how many jobs the student perceives as macro-and-male-oriented (we call this the '*Jobs-macro-men*' belief); $\mathbf{x}_i$ denotes a vector of other characteristics of the student and family socio-economic controls; τ_t stands for academic-year fixed effects (a set of dummy variables to account for the academic year in which the surveyed student is currently undertaking - first, second or third year of the degree), and, finally, u_{if}^I is the error term of the equation. We estimate an equation like 5 separately for macro and for microeconomics.[33]

Then, we estimate a similar model for the students' self-reported statements regarding their relative performance, where we consider, in turn, that the interest in that field may be among the explanatory factors. In this case, the dependent binary indicator is equal to 1 if the student states "*I obtain better grades in this subfield* (macro, micro)" and 0 if the student claims to obtain better grades in the other subfield or expresses a neutral position. The estimation equation in this case can be written as:

$$G_{if} = \alpha + \beta W_i + + \rho I_{if} + \delta \mathbf{z}_i^G + \gamma \mathbf{x}_i + \tau_t + u_{if}^G \qquad \forall f \tag{6}$$

where G_{if} stands for a binary indicator taking the value 1 if the student states that their grades in macroeconomics (microeconomics) are better than in microeconomics (macroeconomics), or are the same. The equation for grades incorporates on the right-hand side the indicator of interest, I_{if}, among its explanatory factors. $\mathbf{z}_i^G$ denotes a vector containing the student's answers to other survey questions that we consider may correlate with their relative grades in the subfield, containing the same variables as $\mathbf{z}_i^I$ except for *initial vocation* and *social concern*. In exploratory work, the latter two variables did not yield statistical significance in the grades equation, which indicates that, beyond their impact through interest, they do not directly affect relative grades.[34]

[33]The LPM or OLS regression on our binary variables yield average partial effects, APE, that prove to be virtually the same as the marginal effects on the average from an alternative Probit estimation. Given its greater flexibility and ease of interpretation, we estimate LPM models for all our binary indicators.

[34]This means that these variables are naturally excluded from the equation for grades, which they only impact through their effect on the interest in the subfield. Hence, the two equations, interest and grades, can be thought of as the first and second stages, respectively, of an instrumental variables setting where the covariates excluded in the equation for interest can be used as instruments to assess the exogeneity of interest in the equation for grades, and thus, its causal effect on grades. At the bottom of Table 8, we report the results for the exogeneity tests and validity of instruments using initial vocation and social concern as instruments for interest in the equation for grades. These results allow us to rule out such endogeneity concerns.

Table 7 and Table 8 report the new results for equations 5 and 6, that is, for interest and grades respectively. Columns 1 and 2 of Table 7 display the results for macroeconomics, while columns 3 to 6 refer to microeconomics. In columns 1 and 3, the effects of the covariates are restricted to being the same for women and men, while in the other columns all covariates are interacted with the women dummy. A first interesting result is that students entering economics with an initial vocation are around 20 percent more likely to answer that they find macroeconomics more interesting than micro. In micro, this variable correlates negatively with students' opinion that this subfield is more interesting.

We find this unequal correlation between initial vocation and interest in the two subfields very relevant because of the likely implications. On the one hand, the fact that entry into economics as a vocation and interest in the subject correlate positively with macro but negatively with micro may reflects the idea that students have a serious misunderstanding of what economics is about. On the other hand, these mistaken beliefs are biased against microeconomics and, thus, they may dissuade from enrolling those that could be more naturally interested in topics addressed by microeconomic theories and empirics, were they aware of them. In gender relative terms, as a higher proportion of women seem to be interested in micro, this could help explain the lower percentage of women that opt for economics as a vocation.[35] The results also support the idea that, if a student views a given subfield as more aligned with social problems, this correlates positively with their statement that this subfield is more interesting than the other (columns 1 and 3 for macro and micro, respectively), with estimated effects broadly comparable in macro and micro (0.134 and 0.123, respectively).

Some of the more compelling results in Table 7 appear when we allow the effects to differ by gender in columns 2 and 4, where we cross all the covariates with the women dummy variable. The results regarding *initial vocation* and *social concern* are equally significant for women and men in macroeconomics.However, in the case of microeconomics, these two variables are more important for women. In fact, the negative correlation between initial vocation and an interest in micro is more pronounced for women and marginally significant at the 12 percent level in their case (coefficient of -0.120 with p-value=0.120), while for men the estimate is much lower and far from being significant. As regards the positive effect of finding microeconomics more concerned with social issues, this is only significant for women, with a coefficient of 0.209 as compared to the (non-significant) 0.026 found for men. This indicates that, for women, the preference for microeconomics is fairly closely related to the degree to which this subfield is perceived to be connected to societal problems.

An additional finding in Table 7 is the fact that, for women, believing a larger number of occupations to be linked to macroeconomics seems to convey the idea that macro is more interesting than micro, while this variable does not render statistical significance in the case of men. This

[35]In a regression of the variable *initial vocation* on the indicator of macro as a more interesting subfield and on the number of occupations associated with macroeconomics (plus socio-economic controls), we found significant positive correlations in the first case (coefficient of 0.077 with p-value=0.031) and in the second case only for men (coefficient 0.158 with p-value=0.045). Thus, entering economics as a vocation is correlated with the interest in macroeconomics, and, in the case of men, also with the number of occupations associated with macro. The women dummy variable is negative in the regression, although not statistically significant. These results correspond to the sample of students in the first year, and are available on request.

latter finding highlights that female students tend to find macroeconomics more interesting as the number of occupations perceived as being held by macroeconomists rises; a practical view. Finally, in this extended regression of column 2, the women dummy reveals that, after discounting the effects of all the included covariates, women still have an unexplained negative interest in macroeconomics as compared to men that is statistically significant at the 10 percent level.

For microeconomics, in columns 5 and 6 we report the results of a robustness check we find worth mentioning. The single dummy variable for women, capturing the relative preference of women for microeconomics that is not accounted for by the rest of the covariates, is greatly affected by the interaction of the women dummy with the AU-score. When the two variables are included, i.e. the isolated women dummy and its interaction with the AU-score, neither of them are statistically significant. As a check for possible collinearity between these two covariates, in column 5 we allow only the women dummy to enter the equation, while in column 6 we include only the interaction of women with the AU-score. In both cases, the results are statistically significant indicating that women show greater interest in micro than men do (column 5) but that, most likely, women's relatively greater interest in micro is associated with the entrance grade of the (female) student.

Summing up, vocational students tend to find macroeconomics more interesting than micro, the perception of a larger number of occupations for macro leads to a greater interest in macro on the part of women, and, after discounting the observable factors, women still report a lower relative interest in macro than men. Women with higher AU-scores tend to show a greater preference for microeconomics than men do, and the perception that this subfield deals with important social problems matters exclusively for women.

Next we move to Table 8, which presents the results for the estimation of students' self-reported statement that they perform relatively better in one of the two subfields. Now we add the variable that captures whether students assess this as the most interesting subfield, which we further interact with the women dummy. In the first specification for macroeconomics in column 1, the AU-score does not seem to exert any significant effect. However, in column 2, where the AU-score is allowed to have different effects for men and women, results show that men with higher AU-scores are more likely to report a better performance in macroeconomics. Nevertheless, the interacted term of the AU-score with the women dummy is negative, significant and almost double that for men, which for women would yield a comparable effect in quantitative terms but with the opposite sign. This result shows that, unlike men, the higher women's AU-score is, the much less likely they are to claim a relatively better performance in macroeconomics. As a result, the relative negative performance of women captured by the isolated women dummy vanishes (the sign is reversed and it is not statistically significant).

Hence, female students of higher ability do not report obtaining better grades in macroeconomics. This result adds further support to our main finding in Section 4 using the administrative data, which reveals that the largest differences between men and women correspond to the upper tail of the grades distribution. The survey data now points to the fact that women in the upper tail of the AU-score distribution (who are almost certainly also in the upper tail of the grades distribution in many of the subjects of the degree) are the ones who are less prone to report a relatively better performance in macroeconomics.

Table 7 : Student's self-statement:
"I find subjects in this subfield more interesting"

	MACROECONOMICS			MICROECONOMICS		
	(1)	(2)	(3)	(4)	(5)	(6)
Women	-0.100*	-1.437*	0.047	-0.109	0.535*	
	(0.056)	(0.758)	(0.037)	(0.554)	(0.298)	
AU-score	0.010	0.019	-0.006	-0.026		-0.025
	(0.020)	(0.023)	(0.018)	(0.021)		(0.019)
W*AU-score		0.010		0.048		0.043**
		(0.040)		(0.034)		(0.019)
Initial Vocation	0.192***	0.248***	-0.065*	-0.021	-0.041	-0.022
	(0.067)	(0.086)	(0.039)	(0.051)	(0.053)	(0.052)
W*Initial Vocation		-0.101		-0.120	-0.094	-0.119
		(0.135)		(0.077)	(0.078)	(0.078)
Social concern	0.134**	0.162**	0.123**	0.026	0.009	0.026
	(0.057)	(0.080)	(0.057)	(0.063)	(0.063)	(0.063)
W*Social concern		-0.072		0.209*	0.214*	0.206*
		(0.116)		(0.113)	(0.111)	(0.112)
Jobs Macro	0.029	-0.004	0.007	0.025*	0.016	0.025*
	(0.022)	(0.029)	(0.013)	(0.014)	(0.016)	(0.015)
W*Jobs Macro		0.074**		-0.020	-0.024	-0.022
		(0.033)		(0.027)	(0.027)	(0.025)
Jobs Men	-0.011	0.021	0.024	0.026	0.020	0.026
	(0.027)	(0.038)	(0.023)	(0.028)	(0.028)	(0.028)
W*Jobs Men		-0.036		0.005	0.006	0.004
		(0.042)		(0.041)	(0.040)	(0.041)
Jobs Macro-Men	0.041	0.022	-0.027	-0.033	-0.026	-0.034
	(0.046)	(0.060)	(0.038)	(0.044)	(0.044)	(0.044)
W*Jobs Macro-Men		0.055		-0.003	0.001	-0.001
		(0.073)		(0.070)	(0.070)	(0.070)
Age	-0.012	-0.016*	-0.003	-0.003	-0.002	-0.002
	(0.008)	(0.009)	(0.003)	(0.003)	(0.003)	(0.003)
W*Age		0.055**		-0.010	-0.020	-0.013
		(0.023)		(0.014)	(0.012)	(0.008)
Year 2	0.301***	0.287***	-0.118***	-0.094**	-0.093**	-0.094**
	(0.067)	(0.068)	(0.041)	(0.042)	(0.042)	(0.042)
Year 3	0.189***	0.135*	-0.042	-0.024	-0.010	-0.022
	(0.069)	(0.075)	(0.049)	(0.051)	(0.051)	(0.049)
Constant	0.431	0.473	0.230	0.364	0.108	0.344
	(0.304)	(0.340)	(0.224)	(0.242)	(0.094)	(0.215)
N Obs	307	307	307	307	308	307
Adj. R^2	0.100	0.113	0.037	0.054	0.043	0.057

Robust standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.01. Control variables are those included in Table 2. AU-score: student's score to access university (averaged grades from high school and the university access exam.

For the case of microeconomics, in all three columns 4 to 6, the variable indicating a higher interest in this subfield has a large and statistically significant effect. Although the effect is not significantly different for women, since women report a higher interest in micro relative to men (results in Table 7), this could help explain why women tend to outperform their male coursemates in microeconomics. That is, more women than men show interest in micro, and this turns out to be a significant explanation of their better grades in this subfield.

Finally, our results in column 3 indicate that the stereotypical belief that the profession is male- and macro-dominated has a significant and appreciable impact on the probability of a woman declaring that she obtains worse grades in macro than in micro, while it does not influence in any way the statements offered by men. The magnitude of the coefficient is considerable, indicating, for example, that a woman perceiving three out of the seven listed occupations as macro- and male-dominated is almost 34 percent more likely to claim that her best grades are not achieved in macroeconomics than a woman who does not hold such a stereotypical view of the profession.

It is hard to make a categorical judgement as to the reasons why this might happen. The most straightforward explanation for such an effect could be that, as the perception of the economics profession being macro- and male-dominated increases, women's discomfort in the degree increases, and this becomes particularly noticeable in their performance in macroeconomics. It could be thought of as a response explained by some degree of stereotype threat: the more convinced a woman is that the profession is dominated by male macroeconomists, the greater her conviction that men outperform women in macroeconomics and, thus, the worse the performance of women in macroeconomics.[36] Alternatively, a relatively worse performance of women in macroeconomics as compared to micro caused by the macro/male-dominated profession belief could be reflected in women's self-selection into given subfields. That is, women might react by focusing their attention and academic effort on the subjects they find more congenial to them and where they expect lower competition with men, a type of female reaction with broad support in the literature (see, e.g., Geenezy and Rustichini, 2004, -and references therein- where the authors provide experimental evidence that women dislike competition when it is against men).

5.3 Peer effects on interests and grades in macro and microeconomics classes

Peers' interests and grades in a class very likely affect individuals' assessments about preferences and their performance. How sensitive men or women are to peer feedback and, more specifically, how this sensitivity might differ depending on the context, has not been widely addressed in the literature.[37] In this part of the paper, we explore whether the atmosphere in macroeconomics and microeconomics classrooms, and, in particular, the percentage of the students' female and

[36] Stereotype threat refers to a situation where a person is concerned with a negative stereotype about their social group (Steele and Aronson, 1995). This concern may cause the person to perform worse when competitors are thought to be better than her/himself. Spencer et al. (1999) found that, unlike men, women's performance in math is negatively affected by the risk of being judged according to the negative stereotype that women have weaker math ability. They hypothesized that the apprehension it causes may disrupt women's math performance. In a recent paper, Iribarry and Rey-Biel (2017) find that women underperform men when the task in which they compete is perceived as favoring men and they are explicitly informed of the presence of a strong rival.

[37] Myhill (2002) describes different patterns of interaction between boys and girls in the classroom, and Crosnoeet al. (2008) support the hypothesis that peer effects differ by gender.

Table 8 : Student's self-statement:
"I obtain better grades in subjects of this subfield"

	MACROECONOMICS			MICROECONOMICS		
	(1)	(2)	(3)	(4)	(5)	(6)
Women	-0.161**	0.070	-0.107	0.060	0.957	0.994
	(0.072)	(0.642)	(0.643)	(0.046)	(0.613)	(0.640)
Interest	0.079	0.061	0.069	0.272*	0.282**	0.276*
	(0.075)	(0.075)	(0.075)	(0.146)	(0.143)	(0.144)
W*Interest	0.113	0.119	0.112	-0.056	-0.068	-0.057
	(0.101)	(0.100)	(0.101)	(0.183)	(0.182)	(0.184)
AU-score	0.010	0.048**	0.049**	-0.035*	-0.023	-0.026
	(0.016)	(0.023)	(0.021)	(0.020)	(0.026)	(0.025)
W*AU-score		-0.080**	-0.073**		-0.039	-0.034
		(0.035)	(0.034)		(0.036)	(0.036)
Jobs Men			-0.010			0.013
			(0.040)			(0.026)
W*Jobs Men			0.026			-0.014
			(0.037)			(0.034)
Jobs Macro			0.029			-0.022
			(0.028)			(0.014)
W*Jobs Macro			0.032			0.005
			(0.031)			(0.033)
Jobs Macro-Men			-0.046			0.056
			(0.064)			(0.047)
W*Jobs Macro-Men			-0.114**			0.006
			(0.058)			(0.062)
Age	0.000	-0.002	-0.002	-0.007	-0.005	-0.003
	(0.008)	(0.008)	(0.008)	(0.005)	(0.005)	(0.005)
W*Age		0.027	0.031		-0.024	-0.028
		(0.020)	(0.020)		(0.019)	(0.021)
Year 2	0.471***	0.466***	0.457***	-0.073	-0.067	-0.068
	(0.067)	(0.067)	(0.067)	(0.052)	(0.053)	(0.053)
Year 3	0.251***	0.214***	0.192***	-0.021	-0.001	0.008
	(0.060)	(0.066)	(0.066)	(0.057)	(0.065)	(0.066)
Constant	0.038	-0.270	-0.293	0.657**	0.471	0.451
	(0.270)	(0.314)	(0.313)	(0.265)	(0.338)	(0.321)
Wu-Hausman Exog.	0.088	0.195	0.078	0.408	0.590	0.631
	(0.766)	(0.658)	(0.779)	(0.522)	(0.442)	(0.426)
Sargan Test.	0.088	0.010	0.041	0.001	0.037	0.036
	(0.766)	(0.921)	(0.839)	(0.973)	(0.847)	(0.849)
N Obs	307	307	307	307	307	307
Adj. R^2	0.206	0.225	0.228	0.058	0.058	0.061

Robust standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.01. Control variables are those included in Table 2. AU-score: student's score to access university (averaged grades from high school and the university access exam.

male classmates who claim to find a subfield more interesting or to obtain better grades, may differentially impact women's and men's own interests and performance. A priori, the signs of these peer effects are unknown to us. In principle, students will be more strongly influenced by those classmates with whom they most often spend time, exchange opinions or share information, who tend to be of the same gender. Conversely, students may be more influenced by those who are perceived as the best at a given subfield, regardless of gender. Perceptions, whether or not they are right, that men or women are relatively better at one subfield than the other may also condition which individuals play a leading role in a classroom and are more capable of generating peer effects. Furthermore, the reaction to these effects may also be gender and subfield specific depending, for example, on the student's own independent interests or abilities. We are not aware of any previous work that deals with peer effects formulated in this way.[38]

The understanding of these peer effects is relevant to this paper. They may reveal whether the social interactions inside the classroom reflect the observed differences in preferences and relative performance in macro vs. micro by male and female students, or if it acts as a mechanism that reinforces the observed differences in interests and performance.

We define our male and female peers' measures for interest and grades and for each subfield s = *macro, micro* as follows. For each student in each group, we define the percentage of their female and male classmates who claim to find that subfield more interesting (we label these peer measures PI^W_{j-is} and PI^M_{j-is}, respectively). Similarly, we construct the percentage of their female and male classmates who claim to obtain better grades in that subfield (PG^W_{j-is} and PG^M_{j-is}, respectively). We then estimate our equations for interest and grades above augmented with the two corresponding peer measures from male and female classmates, which we cross with the dummy variables for women and men, W_i and M_i, to allow the responses to peer effects to differ by gender. Thus, equations 5 and 6 may be rewritten as follows:

$$\begin{aligned} I_{is} &= \alpha + \beta W_i + \phi^{Iw}_W W_i \times PI^W_{j-is} + \phi^{Iw}_M M_i \times PI^W_{j-is} + \\ &+ \phi^{Im}_W W_i \times PI^M_{j-is} + \phi^{Im}_M M_i \times PI^M_{j-is} + \\ &+ \delta \mathbf{z}^I_i + \gamma \mathbf{x}_i + \tau_t + u^I_{is} \end{aligned} \tag{7}$$

$$\begin{aligned} G_{is} &= \alpha + \beta W_i + \phi^{Gw}_W W_i \times PG^W_{j-is} + \phi^{Gw}_M M_i \times PG^W_{j-is} + \\ &+ \phi^{Gm}_W W_i \times PG^M_{j-is} + \phi^{Gm}_M M_i \times PG^M_{j-is} + \\ &+ \delta \mathbf{z}^G_i + \gamma \mathbf{x}_i + \tau_t + u^G_{is} \end{aligned} \tag{8}$$

Identification of the causal effect of peers entails certain difficulties. To begin with, in many educational empirical studies, data do not include class identifiers, which impedes the selection of a student's relevant peers. Our survey data allows us to identify the class, which permits

[38] Peer effects in academic achievement is perhaps one of the most widely-analyzed contexts. Some of the latest contributions are Duflo et al. (2011), Bui et al. (2014) or Vardardottir (2013). Peer effects in cheating at exams are analyzed by Carrell et al. (2008), or in wages in the workplace by Cornelissen et al. (2017).

the construction of the peer measures for each group of students spending class time together at university.[39] In addition, several sources of endogeneity may appear in the analysis of peer effects. Selection bias and other unobserved influences are two of these sources.[40] More notably, the peer effect is inherently endogenous: if peers' outcomes affect individual outcomes, individual outcomes will affect peers' outcomes, leading to simultaneity bias.

Here we follow the most widely-used approach to overcome the endogeneity problem, which consists in using instrumental variables (IVs) for the peer measures (e.g., Goux et al., 2007). These instruments may be constructed from individual measures affecting the individual responses about interests and grades which are exogenous to the error term of the equation. We choose two variables that are predetermined before students enter their respective groups and before their interaction in the classroom starts: the AU-scores and their self-reported statements about initial vocation. With the individual responses to these two variables, we construct the IVs. More specifically, we define for each individual the percentages of males and female peers in the class expressing an initial vocation PV_{j-is} and their respective average AU-scores PAU_{j-is}. In a first stage, we estimate the reduced forms of the male peers' interest and the female peers' interest on the IVs and the rest of the covariates of the main equation. As an example, for the female peer measure in equation 7 the first stage regression takes the general form:

$$PI^W_{is} = \beta_0 + \beta_1 PAU^W_{j-is} + \beta_2 PAU^M_{j-is} + \beta_3 PV^W_{j-is} + \beta_4 PV^M_{j-is} + \beta_5 \mathbf{w}_{is} + e^I_{is} \tag{9}$$

where $\mathbf{w}_{is}$ stands for all the covariates and controls other than the peer measures appearing in the main equation (equation 7 in this case). An equation like 9 is run for each of the four peer measures appearing in equations 7 and 8 above. In the second stage, we plug the first-stage predictions for the peer measures into the right-hand side of the corresponding main equation of interest. To account for the extra variance introduced in the second stage when a first-stage estimated variable is included, we bootstrap the standard errors. The estimation is run for macroeconomics and microeconomics separately, as above. In addition, we cross the peer measures by a men and a women dummy variable to allow the influence of peers to be different on male and on female students.[41]

Table 9 reports the results of the estimation of peer effects, both for macroeconomics and for microeconomics. At the bottom of the table, the F-statistics for joint significance of IVs in the first stage take considerably large values, thus ruling out concerns about the weakness of

[39] The administrative data used in Section 4, for example, do not allow us to identify the class groups.

[40] The so-called *reflection problem* is one of the main sources of such endogeneity. It refers to the endogenous self-selection of individuals into their groups of influence, that is, individuals approach those whose unobservable characteristics are systematically related to theirs.

[41] The application of IV to estimate peer effects present some differences with respect to the IV estimation in the standard setting. Here, the individual variable used to construct the IV does not fulfill an exclusion restriction in the main equation. On the contrary, if an individual covariate is not explanatory of the individual responses its aggregation will probably not correlate with the peer measure. Moreover, the individual variable may enter the main equation together with their peer construction. An example of an application of this approach can be found in Carrell et al. (2008) for the estimation of peer effects in academic cheating.

instruments.[42] The peer effects measures have been standardized for ease of interpretation. Thus, the estimated coefficients measure marginal probabilities of one standard deviation from the mean of the corresponding peer measure.

We first look at the results for students' self-reported interest in macro and in microeconomics. In the case of macroeconomics, the results suggest that the larger the percentage of women in the classroom who show a clear interest in that subfield, the higher the probability that a female student in that classroom will claim to find it interesting too. The estimated coefficient suggests that if the percentage of women in a classroom with a marked interest in macroeconomics (as compared to micro or being neutral) increased by one standard deviation above its mean, the likelihood of a female student declaring that macroeconomics is more interesting than micro would increase by nearly 20 percent. Unlike women, men do not seem to be affected by their peers' interests in macroeconomics. The coefficient, albeit positive, is not significantly estimated. In microeconomics, however, the results suggest that men are positively influenced by their male peers (coefficient of 0.042 with p-value=0.032), and women by their female classmates (coefficient of 0.074 with p-value=0.073). Thus, in microeconomics the estimated effects are lower than in macro, and also lower for men than for women.

These results of peer effects on interest admit the following interpretations. First, the susceptibility of students to their peers' interests, when they exist, is linked to peers of the same gender. Women do not respond to the percentage of men that declare a greater interest in a given subfield, and nor do men to their female peers' interests. These results reflect the idea that friendships are generally stronger between students of the same gender, in line with the established idea that individuals shape their preferences by looking at those with whom they feel more closely identified.[43] Second, men are less responsive than women to their peers' interests. In macro, they are not significantly affected at all, and in microeconomics, though the estimated effect is positive and statistically significant, its magnitude is the lowest among all the estimated impacts. The fact that men do not react to their peers' interest in macroeconomics may be due to their greater individual interest in macroeconomics, which probably exists independently of feedback from others. In micro, a subfield in which they are not on average particularly interested, a higher proportion of interested male classmates may attract their attention to this subfield. In other words, it seems that the lower the initial individual interest, the higher the potential for peer influence to make a difference. This could also help explain the fact that the peer effect for women in macroeconomics is appreciably larger than in microeconomics.

Thus, it seems that there are social multiplier effects in the interests of students towards a subfield, which are particularly important in the case of macroeconomics for women, when the percentage of interested women increases.[44] More women interested in macro drive more and

[42] A full set of group dummies is also included in the estimation to control for other possible group-specific unobservables.

[43] The principle of *homophily* states that individuals prefer other people who are similar to them (McPherson et al., 2001), gender being one of the main aspects of such similarity.

[44] *Social multiplier effect* is a term that refers to the principle that high levels of one attribute among one's peers can have spillover effects on an individual, which, in turn, affect the aggregate attribute generating new individual effects (Glaeser et al., 2003).

Table 9 : Peer effects

	INTERESTING		GRADES	
	MACRO	MICRO	MACRO	MICRO
	(1)	(2)	(3)	(4)
Women	-0.993	-0.243	0.114	0.992*
	(0.912)	(0.595)	(0.728)	(0.599)
Men*Male Peers'	0.057	0.042**	0.156***	0.063*
	(0.057)	(0.019)	(0.057)	(0.033)
Women*Male Peers'	0.037	0.011	0.149**	0.010
	(0.060)	(0.020)	(0.073)	(0.044)
Men*Female Peers'	0.037	0.021	-0.010	-0.027
	(0.064)	(0.031)	(0.069)	(0.039)
Women*Female Peers'	0.198***	0.074*	-0.009	0.088**
	(0.070)	(0.040)	(0.090)	(0.045)
Interesting			0.055	0.284*
			(0.076)	(0.153)
W*Interesting			0.180*	-0.116
			(0.098)	(0.181)
AU-score	0.021	-0.025	0.045*	-0.015
	(0.025)	(0.021)	(0.023)	(0.025)
W*AU-score	0.029	0.041	-0.079**	-0.036
	(0.040)	(0.031)	(0.036)	(0.037)
Initial Vocation	0.249**	-0.011		
	(0.100)	(0.053)		
W*Initial Vocation	-0.034	-0.132*		
	(0.143)	(0.075)		
Social concern	0.161**	0.025		
	(0.077)	(0.065)		
W*Social concern	-0.090	0.227*		
	(0.115)	(0.121)		
Jobs Men	0.018	0.026	-0.001	0.025
	(0.038)	(0.026)	(0.040)	(0.026)
W*Jobs Men	-0.011	0.005	0.018	-0.020
	(0.042)	(0.044)	(0.036)	(0.034)
Jobs Macro	-0.004	0.024	0.033	-0.017
	(0.031)	(0.016)	(0.029)	(0.014)
W*Jobs Macro	0.080**	-0.016	0.028	0.008
	(0.032)	(0.029)	(0.033)	(0.035)
Jobs Macro-Men	0.021	-0.033	-0.073	0.053
	(0.063)	(0.044)	(0.061)	(0.049)
W*Jobs Macro-Men	0.024	0.003	-0.118*	0.014
	(0.073)	(0.073)	(0.066)	(0.065)
Constant	0.278	0.109	-0.302	0.130
	(0.587)	(0.231)	(0.370)	(0.332)
Age, Year	yes (no signif.)	yes (no signif.)	yes (no signif.)	yes (no signif.)
IVs for Peers	Peers' Vocation Peers' AU-scores	Peers' Vocation Peers' AU-scores	Peers' Vocation Peers' AU-scores	Peers' Vocation Peers' AU-scores
First stage F-test (IVs for male peers)	1336.57	319.18	321.17	441.49
First stage F-test (IVs for female peers)	613.58	363.09	103.27	195.71
N Obs	307	307	307	307
Adj. R^2	0.143	0.063	0.244	0.085

Robust standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.01. Control variables are those included in Table 2. AU-score: student's score to access university (averaged grades from high school and the university access exam.

more women to share such an interest. These results line up, for example, with Huntington-Klein and Rose (2018), who find that women's preferences and decisions are affected by greater exposure to women peers, while peer gender has little effect on men. The authors argue that the results may depend on the context, with more potential for peer effects to have an impact when there are fewer women. [45]

Next we focus on the estimation of peer effects on grades. The effects here may come from two main sources. The first is through joint study and accomplishment of tasks by sharing doubts and engaging in discussion, as well as other forms of learning spillovers. The second comes from competition among classmates' peers, which may turn out to have positive or negative effects, depending on each individual's reaction to competitive settings.[46]

Our estimation results do not show negative effects in any case. On the contrary, all significant estimates are positive, exhibiting a selective pattern in this case as well. However, the gender and subject bias of the effects are somewhat different to those obtained for interests. In particular, statistically significant peer effects in macroeconomics originate only from male students, but affect both male and female classmates (with similar estimated coefficients of 0.156 and 0.149, respectively). Neither men nor women seem to be affected by their female peers' performance in macroeconomics. Quite interestingly, though, in microeconomics the patterns differ. In this case, a male student is more likely to indicate a better relative performance in microeconomics as the percentage of male classmates with better grades in micro increases. The same applies to women with respect to their female peers.

The results for peer effects on grades might appear puzzling at first sight. In brief, men seem to collaborate/compete only with their male peers, in both subjects, while women collaborate/compete with classmates of different genders depending on the subfield, namely, male peers in macro and female peers in micro. An initial interpretation of these results could be that both men and women may hold stereotypical ideas as regards which students are the top performers in the classrooms. In this sense, we might argue that men hold gender-biased opinions as regards performance; more specifically, male-biased perceptions of the classmates to look up to. Conversely, for women, the stereotype could be based on precisely what our results in Section 4 have indicated, that is, men tend to outperform women in macro, while women outperform men in microeconomics. To the extent that women perceive a different relative performance of their male and female peers in their classes, they may become convinced that men are the leaders in macro while women are in microeconomics. Thus, women would have what we could refer to as a performance-based or statistical bias.[47] This first interpretation is actually strongly supported by the results in Grunspan et al. (2016). The authors, using classroom data from an introductory undergraduate biology class at a large American university, find a strong male bias among males

[45] In the referenced paper, the context is that of cadets at West Point, a strongly male-dominated environment. In the literature, however, the effects of women's presence on other women's progress are mixed, and depend on the context and the relationships between the women (see references therein).

[46] The seminal paper by Gneezy et al. (2003) opened up the question about women's performance in competitive environments. The follow-up studies generally yield results that depend on the task used to measure competitiveness and the gender composition of the competing group (e.g., Shurchkov, 2012).

[47] Statistical bias or inference (Phelps, 1972) refers to the case whereby people use group statistics as a proxy of the unknown, or imperfect, information about individuals.

when assessing their perceptions about the performance of their female classmates, whom they clearly underrate. In contrast, females seem to rate their peers on the basis of their performance, regardless of gender.

AThere may be alternative explanations for the peer effects on grades. Studies have shown that men tend to participate more actively in the classroom (Lundeberg and Punćcohaŕ, 1994) if they are more interested in the subject matter, as would be expected. According to this view, if men contribute with more comments, questions and opinions in macroeconomics classes, in which they tend to be more interested, they probably gain greater recognition from both their male and female classmates. This, in turn, generates a situation whereby students in the classroom, no matter if they are men or women, are more likely to share tasks, ask for help or even compete with them. In microeconomics, the argument would follow that women fail to convey such an image, and each student collaborates then with peers of the same gender.

Our interpretation of the peer effects analysis is that the social interaction in the classrooms may reflect observed differences in male and female students' preferences and their relative performance in macro vs. micro. Men seem to exert an influential role in macroeconomics classes that seems to be perceived by both men and by women in the classroom. Women with relatively better grades in macro do not have any influential effect on the grades of their peers, and in microeconomics they only influence women. On the other hand, women with a greater interest in macroeconomics have the potential to influence and increase the number of women in a group that show a relatively greater interest in macroeconomics.

6 Summary and conclusions

In this paper we find evidence that, relative to one other, male and female university students perform differently in macroeconomics - and microeconomics - related subjects, more appreciably in the upper quartiles of the grades distribution. This result adds to the fact that, at the research level, women tend to self-select differently across subfields in economics. In particular, women show a higher preference for some of the research topics that we would classify under microeconomics. We have provided evidence of this fact using web scraping and machine learning techniques to gather information from the papers presented at the annual AEA meeting from 2010 to 2016.

Intrigued by our results revealing the different relative performance of male and female students in macro and micro subjects, we surveyed students of economics enrolled at UV in the academic year 2017-2018. Some of their responses are striking, though in fact, confirm the idea that subfields of economics reach women and men differently. As an example, the survey data reveals that women are more likely than men to choose micro as a more interesting subfield and tend to regard micro as less difficult and more intuitive than macroeconomics. It is important to note that women do not exhibit a particular preference or an absolute advantage in microeconomics as compared to macro; rather, they clearly hold a comparative preference and advantage (disadvantage) in micro (macro) as compared to men.

In terms of the most natural occupations for economics graduates, our surveyed students view the economics profession as dominated by macroeconomics, and students entering economics with

higher initial vocation also show a greater interest in macroeconomics. Further, the stereotypical belief that the profession is male- and macro-dominated has a significant and appreciable impact on the probability of a woman declaring that she obtains worse grades in macro than in micro, while it does not influence the statements offered by men at all. As an additional piece of evidence that male students are viewed as the ones playing an influential role in macroeconomics, our peer effects analysis highlights that men are the only ones to influence their peers' performance in macroeconomics classes.

Taken together, the three pieces of evidence provided in this paper convey the idea that there is a subject-bias in the profession that may be connected with the gender imbalance affecting economics at the undergraduate level. The areas where women seem to be relatively more comfortable, either in terms of preferences or performance, are those that seem to be least well known to our students. The main conclusion we draw from our paper is that many microeconomics-related topics are not being effectively conveyed to our students - nor perhaps to the general public - and that correcting this misinformation might be one way to make economics a more appealing discipline for women.

Appendix A: JEL Approach

Table 10 : Correspondence between JEL codes and subfields

JEL code	Name	Area
A	General Economics and Teaching	Others
A0	General Economics and Teaching	Others
A1	General Economics	Others
A2	Economic Education and Teaching of Economics	Micro
A3	Collective Works	Others
B	History of Economic Thought, Methodology, and Heterodox Approaches	Others
B0	History of Economic Thought, Methodology, and Heterodox Approaches	Others
B1	History of Economic Thought through 1925	Others
B2	History of Economic Thought since 1925	Others
B3	History of Economic Thought: Individuals	Others
B4	Economic Methodology	Others
B5	Current Heterodox Approaches	Others
C	Mathematical and Quantitative Methods	Tools
C0	Mathematical and Quantitative Methods	Tools
C1	Econometric and Statistical Methods and Methodology: General	Tools
C2	Single Equation Models. Single Variables	Tools
C3	Multiple or Simultaneous Equation Models. Multiple Variables	Tools
C4	Econometric and Statistical Methods: Special Topics	Tools
C5	Econometric Modeling	Tools
C6	Mathematical Methods. Programming Models. Mathematical and Simulation Modeling	Tools
C7	Game Theory and Bargaining Theory	Micro
C8	Data Collection and Data Estimation Methodology. Computer Programs	Tools
C9	Design of Experiments	Micro
D	Microeconomics	Micro
D0	Microeconomics	Micro
D1	Household Behavior and Family Economics	Micro
D2	Production and Organizations	Micro
D3	Distribution	Micro
D4	Market Structure, Pricing, and Design	Micro
D5	General Equilibrium and Disequilibrium	Micro
D6	Welfare Economics	Micro
D7	Analysis of Collective Decision-Making	Micro
D8	Information, Knowledge, and Uncertainty	Micro
D9	Micro-Based Behavioral Economics	Micro
E	Macroeconomics and Monetary Economics	Macro
E0	Macroeconomics and Monetary Economics	Macro
E1	General Aggregative Models	Macro
E2	Consumption, Saving, Production, Investment, Labor Markets, and Informal Economy	Macro
E3	Prices, Business Fluctuations, and Cycles	Macro
E4	Money and Interest Rates	Macro
E5	Monetary Policy, Central Banking, and the Supply of Money and Credit	Macro
E6	Macroeconomic Policy, Macroeconomic Aspects of Public Finance, and General Outlook	Macro
E7	Macro-Based Behavioral Economics	Macro

JEL code	Name	Area
F	International Economics	Macro
F0	International Economics	Macro
F1	Trade	Macro
F2	International Factor Movements and International Business	Macro
F3	International Finance	Finance
F4	Macroeconomic Aspects of International Trade and Finance	Macro
F5	International Relations, National Security, and International Political Economy	Macro
F6	Economic Impacts of Globalization	Macro
G	Financial Economics	Finance
G0	Financial Economics	Finance
G1	General Financial Markets	Finance
G2	Financial Institutions and Services	Finance
G3	Corporate Finance and Governance	Finance
G4	Behavioral Finance	Micro
H	Public Economics	Micro
H0	Public Economics	Micro
H1	Structure and Scope of Government	Micro
H2	Taxation, Subsidies, and Revenue	Micro
H3	Fiscal Policies and Behavior of Economic Agents	Micro
H4	Publicly Provided Goods	Micro
H5	National Government Expenditures and Related Policies	Micro
H6	National Budget, Deficit, and Debt	Others
H7	State and Local Government. Intergovernmental Relations	Micro
H8	Miscellaneous Issues	Others
I	Health, Education, and Welfare	Micro
I0	Health, Education, and Welfare	Micro
I1	Health	Micro
I2	Education and Research Institutions	Micro
I3	Welfare, Well-Being, and Poverty	Micro
J	Labor and Demographic Economics	Micro
J0	Labor and Demographic Economics	Macro
J1	Demographic Economics	Others
J2	Demand and Supply of Labor	Micro
J3	Wages, Compensation, and Labor Costs	Micro
J4	Particular Labor Markets	Micro
J5	Labor-Management Relations, Trade Unions, and Collective Bargaining	Micro
J6	Mobility, Unemployment, Vacancies, and Immigrant Workers	Micro
J7	Labor Discrimination	Micro
J8	Labor Standards: National and International	Micro
K	Law and Economics	Micro
K0	Law and Economics	Others
K1	Basic Areas of Law	Micro
K2	Regulation and Business Law	Micro
K3	Other Substantive Areas of Law	Micro
K4	Legal Procedure, the Legal System, and Illegal Behavior	Micro

JEL code	Name	Area
L	Industrial Organization	Micro
L0	Industrial Organization	Micro
L1	Market Structure, Firm Strategy, and Market Performance	Micro
L2	Firm Objectives, Organization, and Behavior	Micro
L3	Nonprofit Organizations and Public Enterprise	Micro
L4	Antitrust Issues and Policies	Micro
L5	Regulation and Industrial Policy	Micro
L6	Industry Studies: Manufacturing	Micro
L7	Industry Studies: Primary Products and Construction	Micro
L8	Industry Studies: Services	Micro
L9	Industry Studies: Transportation and Utilities	Micro
M	Business Administration and Business Economics. Marketing. Accounting. Personnel Economics	Others
M0	Business Administration and Business Economics. Marketing. Accounting. Personnel Economics	Micro
M1	Business Administration	Others
M2	Business Economics	Others
M3	Marketing and Advertising	Others
M4	Accounting and Auditing	Others
M5	Personnel Economics	Others
N	Economic History	Others
N0	Economic History	Others
N1	Macroeconomics and Monetary Economics. Industrial Structure. Growth. Fluctuations	Macro
N2	Financial Markets and Institutions	Finance
N3	Labor and Consumers, Demography, Education, Health, Welfare, Income, Wealth, Religion, and Philanthropy	Micro
N4	Government, War, Law, International Relations, and Regulation	Others
N5	Agriculture, Natural Resources, Environment, and Extractive Industries	Others
N6	Manufacturing and Construction	Others
N7	Transport, Trade, Energy, Technology, and Other Services	Others
N8	Micro-Business History	Micro
N9	Regional and Urban History	Micro
O	Economic Development, Innovation, Technological Change, and Growth	Macro
O0	Economic Development, Innovation, Technological Change, and Growth	Macro
O1	Economic Development	Micro
O2	Development Planning and Policy	Micro
O3	Innovation. Research and Development. Technological Change. Intellectual Property Rights	Micro
O4	Economic Growth and Aggregate Productivity	Macro
O5	Economywide Country Studies	Macro
P	Economic Systems	Others
P0	Economic Systems	Macro
P1	Capitalist Systems	Others
P2	Socialist Systems and Transitional Economies	Others
P3	Socialist Institutions and Their Transitions	Others
P4	Other Economic Systems	Others
P5	Comparative Economic Systems	Others
Q	Agricultural and Natural Resource Economics. Environmental and Ecological Economics	Micro
Q0	Agricultural and Natural Resource Economics. Environmental and Ecological Economics	Micro
Q1	Agriculture	Others
Q2	Renewable Resources and Conservation	Micro
Q3	Nonrenewable Resources and Conservation	Micro
Q4	Energy	Micro
Q5	Environmental Economics	Micro
R	Urban, Rural, Regional, Real Estate, and Transportation Economics	Micro
R0	Urban, Rural, Regional, Real Estate, and Transportation Economics	Micro
R1	General Regional Economics	Others
R2	Household Analysis	Micro
R3	Real Estate Markets, Spatial Production Analysis, and Firm Location	Micro
R4	Transportation Economics	Micro
R5	Regional Government Analysis	Others

JEL code	Name	Area
Y	Miscellaneous Categories	Others
Y0	Miscellaneous Categories	Others
Y1	Data: Tables and Charts	Tools
Y2	Introductory Material	Others
Y3	Book Reviews (unclassified)	Others
Y4	Dissertations (unclassified)	Others
Y5	Further Reading (unclassified)	Others
Y6	Excerpts	Others
Y7	No Author General Discussions	Others
Y8	Related Disciplines	Others
Y9	Other	Others
Z	Other Special Topics	Others
Z0	Other Special Topics	Others
Z1	Cultural Economics. Economic Sociology. Economic Anthropology	Others
Z2	Sports Economics	Others
Z3	Tourism Economics	Others

Table 11 : Classification by themes of AEA papers

Cloud (main stems)	Rank	Share of Women 2014	2015	2016	Number of papers (average)
women, differ, gender, educ, time, children, famili, outcom, gap, child	1	46.93%	40.67%	47.58%	110
program, school, student, educ, test, colleg, outcom, learn, high	2	39.80%	28.46%	33.49%	79
state, health, insur, care, servic, medic, law, provid, spend, reform	3	28.04%	28.47%	37.21%	69
econom, institut, social, paper, will, research, process, provis, societi, discuss	4	24.84%	34.92%	32.95%	122
effect,increase, result, find, impact, signific, evid, suggest, show, point	5	40.30%	30.00%	18.46%	39
labor, employ, worker, wage, chang, job, market, occup, work, unemploy	6	25.75%	30.43%	27.73%	98
product, country, trade, import, intern, cost, export, sector, domes, foreign	7	22.52%	31.95%	24.72%	77
incom, household, tax, wealth, data, survey, inequ, consumpt, transfer, save	8	25.88%	27.69%	20.42%	90
data, use, measur, network, local, differ, level, new, citi, geograph	9	20.91%	26.96%	23.97%	67
firm, invest, manag, perform, industri, corpor, capit, valu, compani, innov	10	23.66%	21.10%	26.34%	112

Classification by themes of AEA papers (continued)

Cloud (main stems)	Rank	Share of Women 2014	2015	2016	Number of papers (average)
behavior, individu, experi, decis, prefer, make, incent, mechan, social, differ	11	23.88%	18.72%	25.96%	92
financi, bank, system, market, risk, crisi, capit, liquid, debt, central	12	28.46%	17.79%	18.43%	102
chang, use, technolog, result, generat, polici, agricultur, increase, cost, adopt	13	23.88%	16.15%	23.47%	78
hous, credit, loan, contract, debt, borrow, rate, valu, home, default	14	19.75%	22.36%	19.30%	81
growth, develop, econom, countri, capit, china, world, resourc, region, human	15	18.92%	18.06%	18.60%	70
polici, rate, shock, interest, exchange, economi, monetary, output, recess, lower	16	19.61%	19.27%	12.87%	77
market, price, inform, consum, competit, provid, effici, transact, sale, demand	17	18.79%	15.09%	15.84%	83
estim, use, variabl, distribut, identifi, test, bias, function, sampl, instrument	18	13.68%	19.57%	14.91%	68
risk, return, fund, asset, stock, signific, evid, suggest, show, point	19	15.63%	15.53%	14.51%	109
model, optim, can, welfar, dynam, equilibrium, welfare, show, predict, general	20	9.52%	16.41%	15.65%	70

Appendix B: complementary material and tables.

Table 12 : Classification of modules at UV into subfields

	Core and Compulsory	Optional
Macroeconomics	Macroeconomics (principles) Macroeconomics (intermediate) Advanced Macroeconomics Dynamic Macroeconomics	International Macroeconomics. Topics in Applied Macroeconomics. Growth Theory.
Microeconomics	Microeconomics (principles) Microeconomics (intemediate) Advanced Microeconomics Games and Strategic Behaviour.	Industrial Organization. Applied Industrial Economics. Labour Economics. Topics in Applied Microeconomics. Game Theory. Natural Resources Theory. Microeconomics: Markets and Contracts.
Finance	Financial Accounting Financial Maths Principles of Financial Management Financial Information Analysis	Management in Banking and Finance. Business Finance. Theory of Banking and Finance. Financial and Monetary Policy. Financial Markets and Bank Operations.
Tools	Statistics Maths Mathematical Programming Econometrics (principles) Econometrics (intermediate)	Data Analysis in Economics. Introduction to Maths for Business. Econometric Applications. Maths for Dynamic Models.
Other	Basics of Law European Union Economy Economic History Foundations of Business Management Accounting Economic Policy (principles) Economic Policy (advanced) International Economics Public Economics	Regional Economics. International Trade. Competitiveness and R&D Policies. Growth and Development in Ec. History. Agricultural Economics. Social Economics. Public Economics Evaluation. Economic Policy in the UE. Public Regulation. Tax System in Spain. Regional and Local Development Policies. Monetary Integration. Business Strategies. Federal Taxation. Contemporary Economic Thinking .

Modules difficult to categorize by their subject matter have been classified according to the fields of the departments that are in charge of the module.

Table 13 : QR OF GRADES IN OPTIONAL MODULES BY SUBFIELD (WITH AND WITHOUT SELECTION CORRECTION)

	Macro No corr.	Macro Select corr.	Micro No corr.	Micro Select corr.	Finance No corr.	Finance Select corr.	Tools No corr.	Tools Select corr.	Other No corr.	Other Select corr.
Women	-0.521	-0.584*	0.364***	0.352***	0.102	0.180	0.078	0.014	-0.028	-0.019
	(0.333)	(0.332)	(0.087)	(0.106)	(0.166)	(0.168)	(0.138)	(0.143)	(0.032)	(0.031)
AU-score	0.049	-0.091	0.226***	0.092**	0.177***	0.184***	0.208***	0.279***	0.119***	0.094***
	(0.136)	(0.139)	(0.048)	(0.040)	(0.056)	(0.052)	(0.054)	(0.056)	(0.013)	(0.014)
W*AU-score	0.129	0.155	-0.098**	-0.074	-0.007	-0.028	-0.030	-0.067	-0.004	-0.001
	(0.189)	(0.175)	(0.041)	(0.050)	(0.083)	(0.072)	(0.067)	(0.068)	(0.019)	(0.017)
Age	-0.042**	-0.057***	-0.014**	0.004	-0.012	-0.011	0.001	-0.008	-0.009***	-0.002
	(0.016)	(0.017)	(0.007)	(0.011)	(0.013)	(0.012)	(0.014)	(0.014)	(0.003)	(0.003)
Standard high school	0.322	-0.015	0.326	0.074	0.175	0.335*	0.132	0.623**	0.233***	0.175***
	(0.693)	(0.702)	(0.198)	(0.155)	(0.183)	(0.192)	(0.263)	(0.246)	(0.051)	(0.055)
Vocational high school	-0.396	-0.521	0.298	0.416**	0.325	0.284	0.164	0.185	0.165***	0.106*
	(0.772)	(0.720)	(0.233)	(0.198)	(0.223)	(0.224)	(0.289)	(0.279)	(0.063)	(0.059)
Fulltime student	0.432	0.208	0.289*	0.180	0.017	0.015	0.246*	0.216	0.125***	0.127***
	(0.273)	(0.282)	(0.168)	(0.116)	(0.172)	(0.169)	(0.136)	(0.144)	(0.030)	(0.031)
Living at home	-0.117	-0.052	0.018	0.151	0.127	0.124	-0.006	0.005	-0.014	0.006
	(0.243)	(0.213)	(0.064)	(0.097)	(0.134)	(0.129)	(0.115)	(0.113)	(0.024)	(0.024)
SNP index		1.330***		0.645***		0.946***		-0.567***		-0.550***
		(0.280)		(0.087)		(0.256)		(0.134)		(0.050)
SNP index ^{2}				0.293***				0.213***		0.456***
				(0.065)				(0.048)		(0.066)
SNP index ^{3}				-0.096***						0.215***
				(0.025)						(0.042)
Constant	9.477***	8.626***	5.702***	5.579***	6.422***	5.694***	5.699***	5.710***	5.061***	4.994***
	(1.363)	(1.359)	(0.630)	(0.408)	(0.799)	(0.762)	(0.565)	(0.577)	(0.176)	(0.160)
N Obs	256	256	1572	1572	735	735	1048	1048	12511	12511
Adj. R^2	0.176	0.256	0.051	0.115	0.071	0.128	0.069	0.091	0.426	0.437

Bootstrapped errors in parentheses (500 replications). * p<0.10 ** p<0.05 *** p<0.01. All regressions include module-year effects, year dummies and the complete set of socio-economic controls included in Table 2. AU-score: student's score to access university (averaged grades from high school and the university access exam.

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